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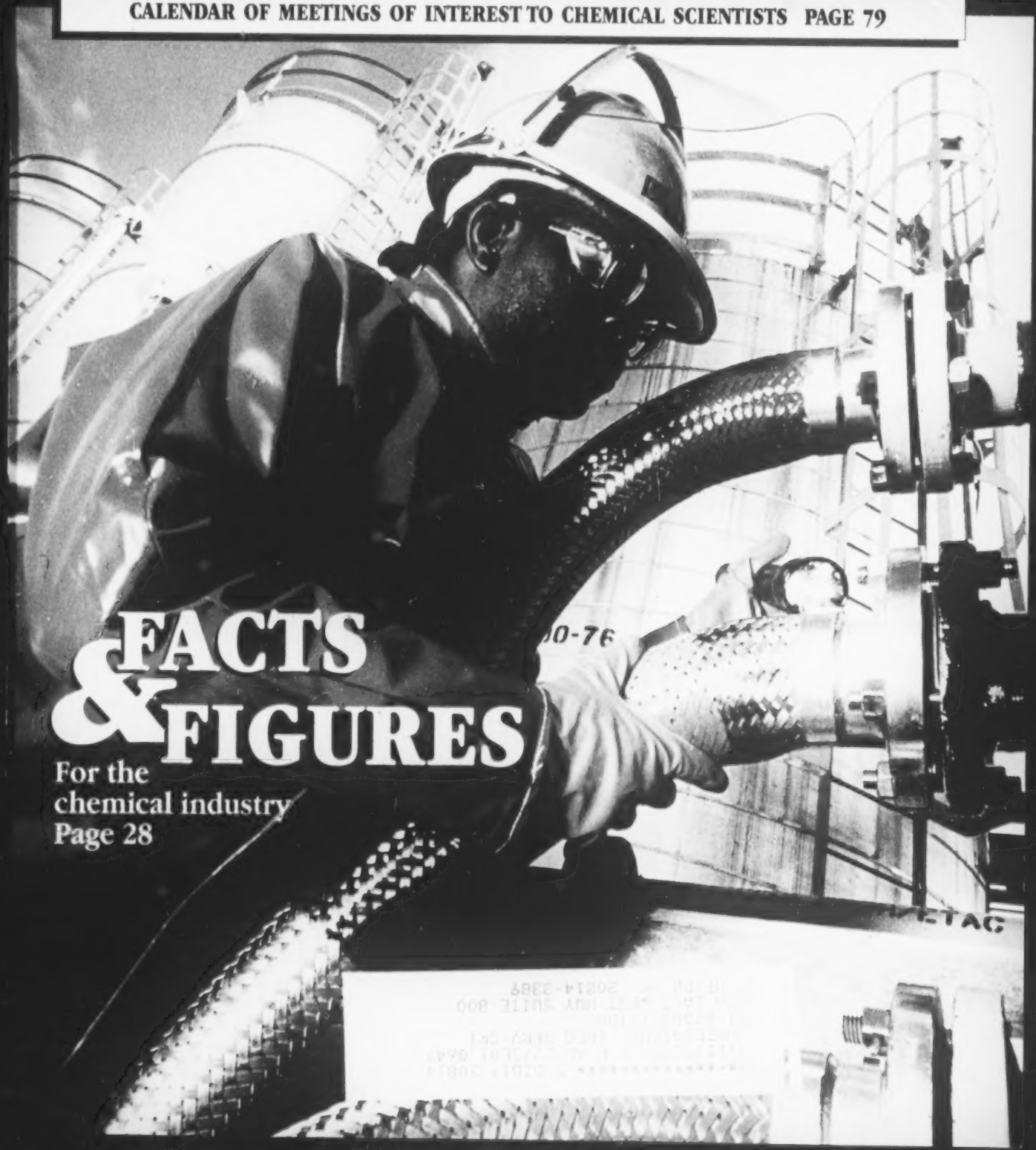
CHEMICAL & ENGINEERING NEWS

C&EN

JULY 4, 1994

CALENDAR OF MEETINGS OF INTEREST TO CHEMICAL SCIENTISTS PAGE 79



FACTS & FIGURES

For the chemical industry
Page 28

CHEMICAL & ENGINEERING NEWS

C&EN

JULY 4, 1994

NEWS OF THE WEEK

■ The long-sought target of the immunosuppressant drug rapamycin in mammalian cells—a previously unknown protein—has been discovered independently by four research groups. **Page 6**

■ Scientists report that trifluoroacetic acid—a major breakdown product of leading CFC substitutes—is degraded by soil microbes and thus may cause less environmental harm than originally feared. **Page 7**

■ Mobil Corp. will eliminate 2,300 jobs from its chemical businesses—reducing work force by nearly 20%—and close some plastic production facilities as part of restructuring program. **Page 8**

■ Eli Lilly and Somatogen agree to collaborate in the development, clinical testing, production, and marketing of genetically engineered hemoglobin—a blood substitute product. **Page 8**

■ Solvay Polymers modifies resin production processes, uses vegetable stearates to make polyethylene and polypropylene for food packaging that meets kosher certification standards. **Page 9**

■ Four top high school chemistry students are named members of U.S. team to compete in the 26th International Chemistry Olympiad in Oslo, Norway. **Page 9**

COVER: Employee checks raw material supply line in Albemarle's Orangeburg, S.C., ibuprofen plant

Volume 72, Number 27
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BUSINESS

Producers of chlorofluorocarbon alternatives boost output as 1996 phaseout deadline approaches, but illegal supplies of CFCs may reduce demand for new products. **Page 12**

Specialty chemicals producer Witco opens on the German stock exchange in a show of the company's commitment as a supplier to the European market. **Page 14**

Business Insights: Business Roundtable, a lobbying group, calls for government to reengineer the regulatory process. **Page 15**

GOVERNMENT

Congressional committees return to issues such as competitiveness, worker safety and health, and NSF reauthorization after intense debate on health care reform. **Page 18**

Chairman of new panel on research ethics decries apathy of scientific community toward scientific misconduct. **Page 20**

SCIENCE/TECHNOLOGY

A molecular sieve with novel structural features has been synthesized by Mobil Research & Development for catalytic applications in petrochemistry. **Page 23**

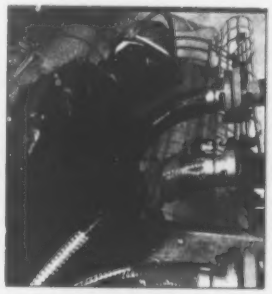
EDUCATION

Hoffmann-La Roche presents awards for a new scholarship program honoring excellence in organic chemistry as part of its outreach to graduate students. **Page 24**

MEETINGS

C&EN's semiannual calendar lists scientific meetings and events scheduled through July 1995. **Page 79**

FACTS & FIGURES



C&EN's annual statistical survey of the chemical industry in the U.S. and abroad finds that most indicators of industry health—earnings, sales, shipments, and profitability—moved upward in 1993, although employment, capital spending, and R&D budgets either dropped or remained at 1992 levels. **Page 28**

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LETTERS

Insights on the economy

The article on interest rates by William Storck (C&EN, June 6, page 19) was far more insightful than intended. Admittedly, these observations will represent hindsight to some degree but in doing so will provide a benchmark on economists as well as economics.

The author mentions the analogy of the Federal Reserve Board's control as taking away the punch bowl just as the party is getting good. Unfortunately, this trivializes the situation. What the Fed did was more akin to inserting a control rod in a nuclear process that was going critical and headed toward meltdown and fallout. The economy itself was not becoming overheated—it was the market, which was assuming an identity independent of the economy that it ostensibly represented.

This was true because stock values no longer represented a valid evaluation of the businesses supporting the stocks. Price-earnings ratios and dividends bore little relation to the stock values. The stock values were dependent on future purchasers bidding the prices higher, which is known in some circles as "the greater fool" concept, and in others as the Ponzi Principle. In addition, leveraged speculation called derivatives was betting on anything from commodities to interest rates to market averages. It was a potential replay of 1929 in which the boom was followed by a bust that had an economic fallout extending far beyond the market itself. Whether this was the goal or thinking of Greenspan and the Fed is impossible to judge, but if the market begins to go critical again, speculators beware.

But a second point may be made. The June 13 issue of *Fortune* comments that there is no inflation in the near future—that bondholders may feel secure. Yet the June 27 issue carries an in-depth evaluation of price rises in a number of basic commodities. Are the data incorrect, or the economists, or does this indicate a problem having to do with economics and the U.S. economy? Or did Greenspan know more than he was telling? What it may indicate is that the U.S. economy is very thin, that supply is relatively inelastic so that a small change in demand results in a relatively large change in price.

This is reflected in the dispute concerning the rate of unemployment, which will not result in wage increases. Is it 6.2% or 5.9%, and what will the Fed target as the correct interest rate to achieve the optimum unemployment rate as it takes inflation into account?

The proper answer is that these considerations involve fiscal policy and the relationship to society. The overemphasis on monetary policy and infrastructure while ignoring fiscal policy and social infrastructure may have put us in an inextricable position.

Leonard Clapp
Wilmington, Del.

No 'coincidence'

Regarding the "intriguing pattern" in atomic numbers of man-made elements (C&EN, June 13, page 4), every chemist should know that nucleon "configurations," like their electron kin, are governed by quantum mechanics, and that it is no "coincidence" for nuclear properties to exhibit periodicity where numbers of protons differ by "filled shells" of $2(2n + 1)$.

Peter Green
California Institute of Technology
Pasadena

Bader's contributions

I applaud the selection of Alfred Bader for the 1995 Parsons Award. By his long and distinguished service, Bader has earned a unique place in organic chemistry. The Aldrich catalog became the standard reference on many desks. One of his imaginative and helpful contributions has been the "ABC Library of Rare Chemicals," in which collections of research samples from laboratories all over the world were purchased, cataloged, and made available, even in the days when disposal of chemicals was becoming a major headache and expense.

James A. Moore
University of Delaware
Newark

Correction

• June 27, page 44: J. J. Thomson's name was misspelled in the book review. He discovered the electron in 1897, not 1987.

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Producers of CFC Alternatives Gear Up For 1996 Phaseout

■ ***Capacity for some CFC alternatives builds as phaseout deadline nears, but black market supply is raising serious concerns***

The summer of 1995 will be the last for chlorofluorocarbon (CFC) coolant production in the U.S. for, among other uses, automobile air conditioners and ice-cream machines.

In November 1992, the Montreal Protocol on Substances That Deplete the Ozone Layer was revised to phase out CFCs by Jan. 1, 1996. This agreement made way for hydrofluorocarbons (HFCs) and hydrochlorofluorocarbons (HCFCs) to replace CFCs in some of their uses. Alternatives plants are up and expanding, many equipment manufacturers are finalizing their switchover plans, and producers are already looking to replace the transitional HCFCs.

Some replacements are becoming standardized: air conditioners in new cars and retrofits and compressors in home refrigerators are being switched from CFC-12 to HFC-134a, and HCFC-141b is replacing CFC-11 in polyurethane foam insulation for refrigerators. Large building cooling systems that use CFC-12 and CFC-11 are switching to HFC-134a and HCFC-123, respectively.

Meanwhile there are twists in the CFC market. With the $4.35 per lb excise tax nearly half the price of legitimate product, a "black market" in CFCs has arisen. For at least six months now, there have been reports of CFCs offered at prices below the excise tax. "It's affecting everybody's business," says Dave McDonald, product manager for fluorocarbons at LaRoche Chemicals. The black market has kept the price of CFCs down. And if unchecked, adds Craig Wien, AlliedSignal's fluorocarbons controller, it could eliminate incentives for users to switch to alternatives.

Producers speculate that the cheap CFCs are imports that have been tagged as recycled—and hence not subject to the excise tax—or mislabeled as other chemicals. Producers and the Environmental Protection Agency challenge the legitimacy of recycling claims. Says Dave Stirpe, assistant director of Alliance for Responsible Atmospheric Policy, an industry group composed of producers and users of CFCs and alternatives, "In some cases it's virgin material that's a little off-spec." There is evidence that some of the product comes from Russia. Says Stirpe, "It's hard to believe that Russia has an excess of recycled CFCs."

EPA has alerted customs officials to look for illegal imports, says Stephen R. Seidel, acting director of EPA's stratospheric protection division, and has met with the Internal Revenue Service to clarify the excise tax situation. Seidel says the issue will likely be addressed this month at a Montreal protocol working group meeting, and he adds that there are also reports of unusual imports in Europe.

Even without the competition from possibly illegal sources, CFC demand has dropped in 1994. "There's no shortage of CFCs," remarks John Bray, DuPont business manager for fluorochemicals, despite production and import allowances that are merely 25% of 1986 levels. All the U.S. producers are producing their limits, but Elf Atochem general manager for fluorocarbons Jerry Dziedzic says he expects that CFC production might slip below allowances next year. Despite the decreased demand, Seidel says there is still enough to warrant DuPont's continued production of CFCs through the end of 1995, as requested by the government (C&EN, Jan. 3, page 8).

In the alternatives arena, the newest battle is over replacements for the HCFC-22 traditionally used in household air-conditioning units. With its use to be restricted in 2010, HCFC-22 was a "secondary product," according to DuPont's development and technical service manager Helen Connon. "Now it's moved up to a higher priority." DuPont's proposed offering is Suva AC9000, a patented blend of HFC-32, -125, and -134a. AlliedSignal's AZ-50 is an azeotrope of HFC-32 and -125. Under a recent legal decision, AlliedSignal can also offer the HFC-32, -125, and -134a blend.

Commercial refrigeration "gained a lot of momentum this year" in its transition from R502 to alternatives, says AlliedSignal's Wien. Hundreds of thousands of units have been retrofitted already, and many supermarket chains have begun retrofitting plans.

The home refrigerator market is ex-

Decline in CFC production is not offset by gains in alternatives

Product	Net gain or loss 1992–97[a] (millions of lb)	Primary end uses affected
CFC-12	–205	Mobil air conditioners, commercial and industrial refrigeration
CFC-11	–100	Rigid polyurethane foams, commercial chillers
CFC-113	–50	Precision and electronics solvent cleaning
HFC-134a	+100	Mobil air conditioners, commercial chillers, residential refrigerators
HCFC-141b	+65	Rigid polyurethane foams
HCFC-22	+60	Unitary air-conditioning, polymer manufacture, aerosols, polystyrene foams
HCFC-123	+15	Commercial chillers
HFC-125	+10	Commercial and industrial refrigeration
HFC-152a	+10	Commercial and industrial refrigeration, aerosols

[a] Production of virgin chemical. **Source:** SRI International

DuPont's Connon tests auto retrofit.

pected to begin the transition to alternatives this fall. It was one of the more difficult to switch because energy efficiency requirements stalled research on the new refrigerants.

The phaseout has inspired capacity buildups in HFCs and HCFCs, although they won't match CFC production at its height of 887 million lb in 1988, with 41% going to coolant use. Recycling and better leak prevention, as well as not-in-kind replacements, have reduced the market. DuPont now estimates that HCFCs and HFCs will grab only 26% of the CFC market. Some producers, DuPont's Bray adds, have halted plans to build additional alternatives plants. "The market is not as strong as was expected four years ago."

Much of the alternatives demand will be realized only when the repair service market grows. For supermarket refrigerator coolants, the service market is four times the size of the market for chemicals in new equipment; for automotive use, it is a factor of three.

AlliedSignal just started up the first phase of its newest production facility for CFC substitutes in Geismar, La., in June. Its annual capacity of 30 million lb for HFC-134a, HFC-125, HCFC-123, and HCFC-124 is to be doubled in 1996.

In the fourth quarter of 1993, LaRoche Chemicals started up its CFC alternatives plant in Gramercy, La., making 60 million lb per year of HCFC-141b and HCFC-22 combined in a swing plant. Although LaRoche has no formal plans for another plant, McDonald says the company is exploring alternatives.

The hydrofluorocarbon market is being splintered by needs for specialized mixes, according to SRI International senior consultant Rosemary Bradley, with companies offering a few dozen products. "Some products may have relatively small markets," she says, with slightly different blends for different equipment manufacturers.

HFC-134a appears to be the biggest winner, though. DuPont produces HFC-134a at Corpus Christi, Tex. Elf Atochem added equipment to increase HFC-134a capacity at its Calvert City, Ky., plant in April. ICI is doubling HFC-134a capacity at St. Gabriel, La., to 44 million lb per year through improved catalysts and plans to ramp up production to 65 million lb per year in 1996 with an even more efficient catalyst.

ICI was once a bit player in the U.S. CFC market, but now, says ICI marketing manager Dennis Berry about the move to HFC-134a, "our market share is significant, [and] we intend to stay big."

More next-generation research is focused on longer chain HFCs. Wien says AlliedSignal is looking at HFC-245 and HFC-356 for foams. But, adds Wien, as you go to longer chains, "production and process chemistry get a little more difficult and more expensive." DuPont says it is also looking at industry trends while testing fluorinated ethers and flammable hydrocarbons.

Joseph Mendelson, director of the ozone campaign at Friends of the Earth, an environmental activist group, wants to encourage research on nonfluorocarbons. "We've always looked at HFCs and HCFCs as transitional substances," he remarks. He points to hydrocarbon refrigerants that are gaining ground in Europe, but U.S. producers say manufacturers will be reluctant to use flammables because of the likelihood of litigation in case of accidents.

And EPA is addressing concerns for the fluorocarbons' global warming potential, according to Seidel. EPA already requires HFC recycling and emission controls for HFCs.

"All in all, the switchover is remarkably smooth," says Seidel. But come New Year's Day 1996, warns McDonald, "there will definitely be some crying. It won't be painless."

Elisabeth Kirschner

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FACTS & FIGURES

FOR THE CHEMICAL INDUSTRY

AT A GLANCE

1 PRODUCTION

Chemical production in the U.S. rose 3% in 1993, following a similar rise in 1992. The biggest volume commodity chemicals also posted 3% growth in output, as did thermoplastic resins. Almost all sectors showed similar steady, if unspectacular, expansion. Page 30

2 FINANCES

Sales, earnings, profitability, and return on stockholders' investment all grew last year, though sales, in particular, did so only modestly. After four years of falling income, the combined earnings of 30 major chemical firms rose 8%, well above the 2% gains in both sales and prices. Profits came by cutting costs, particularly payrolls but also capital spending. R&D budgets were unchanged from the previous year. Page 37

3 EMPLOYMENT

Companies cut their work forces in 1993, with chemical firms collectively dropping 14,000 people from their payrolls. Worst hit were workers in big companies making organics, agricultural chemicals, or plastics. The slide continued into early 1994, although there are some signs it may now be easing. Employment at drug and soap manufacturers grew in 1993. Page 54

4 MARKETS

Most major markets for chemicals posted their second year of solid growth in 1993, as the U.S. economy generally confirmed that its most recent recession was over. Demand for new homes and for cars and trucks was up strongly, thanks largely to lower interest rates. Farmers, however, did not do well, as bad weather cut crop production 14%. Page 58

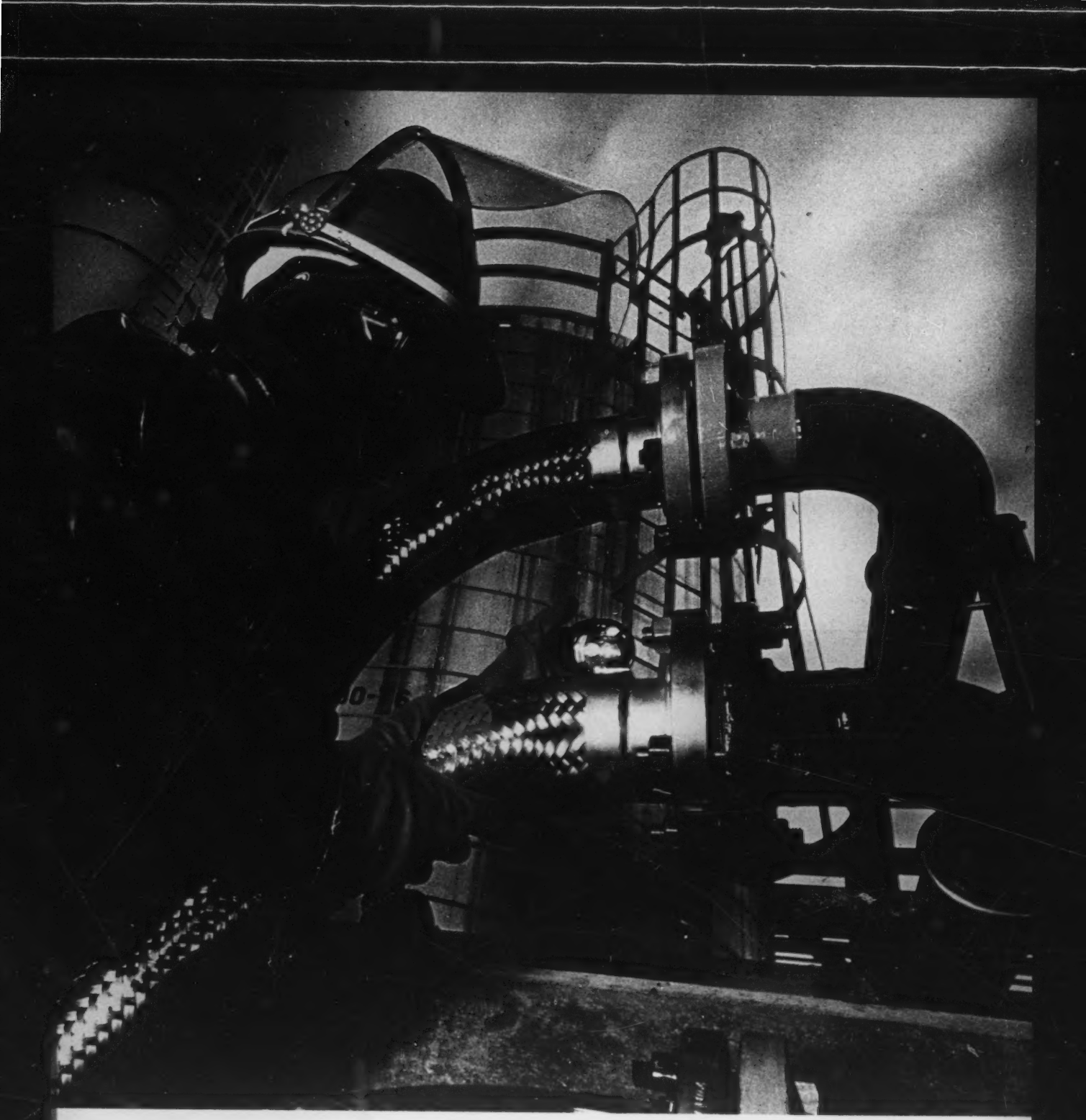
5 FOREIGN TRADE

U.S. chemical exports managed to rise a modest 2.5% in 1993, despite a U.S. economy that was strong compared with those of many of the industry's leading trading partners. But chemical imports rose faster, up 5.4%, causing the chemical trade balance, always strongly positive, to dip below $16 billion for the first time since 1989. Page 60

6 FOREIGN CHEMICAL INDUSTRIES

Cautious optimism is beginning to characterize the chemical industries in Europe and Canada as sales and earnings began to turn around last year for most of these countries. As in the U.S., job trimming was a major contributor to increased profitability. In Japan, sales slipped and earnings plummeted. For many of its less-developed Asian neighbors, however, 1993 was a strong year for chemicals, thanks to generally booming economies. Page 62

Most U.S. chemical makers were probably ready to have a year like 1993. Few would call it outstanding, certainly not when compared with the sort of growth companies were racking up year after year as recently as the late 1980s. But earnings rose substantially, particularly in the year's second half, and most other indicators of industry health—such as sales, shipments, and profitability—moved upward as well. After four years of decline when earnings for ma-



jor chemical firms fell 40% from their 1989 peak, the change was certainly welcome.

The earnings gains came, for the most part, not from stronger demand and rising prices, but through cutting costs and increasing productivity. Chemical companies that had held on to their employees through the economically lean years of the early 1990s decided in 1993 that they could no longer do so. The industry as a whole ended the year with 14,000 fewer employees than it began with, and these cuts have continued well into 1994. Job loss has been even greater at the companies that are the biggest producers of commodity chemicals. Capital spending, too, dropped 10% at the largest chemical firms last year, and even R&D budgets were held to 1992 levels.

The picture was largely the same for chemical makers in Canada and much of Europe, although changes in data collection in some of Europe's key chemical-producing nations cloud the picture there. Turnaround has been slower to reach Japan, however, where chemical profits at 12 leading companies dropped a stunning 40%.

There are signs that the belt tightening may have eased in the U.S. and the now trim chemical industry may find 1994 an even better year than 1993. Chemical sales are up in the early months of 1994, as are company earnings; job cuts have slowed; and plans, at least, call for an increase in capital spending later in the year.

Growth continues in chemical production

Production by the U.S. chemical industry grew 3% in 1993. That's the increase measured by the industry's index of production, prepared by the Federal Reserve Board. C&EN's own tally of production of the largest volume chemicals, the Top 50, shows the same 3% increase. Output by both measures grew 3% in 1992 as well, after being essentially unchanged in 1991.

Production for individual chemical categories varied widely, however. Output for organic chemicals in C&EN's Top 50 rose an overall 9%, whereas that for inorganics fell 1%. A 10% drop in production of sulfuric acid, the chemical that heads the Top 50 list, contributed much to inorganics' overall poor performance.

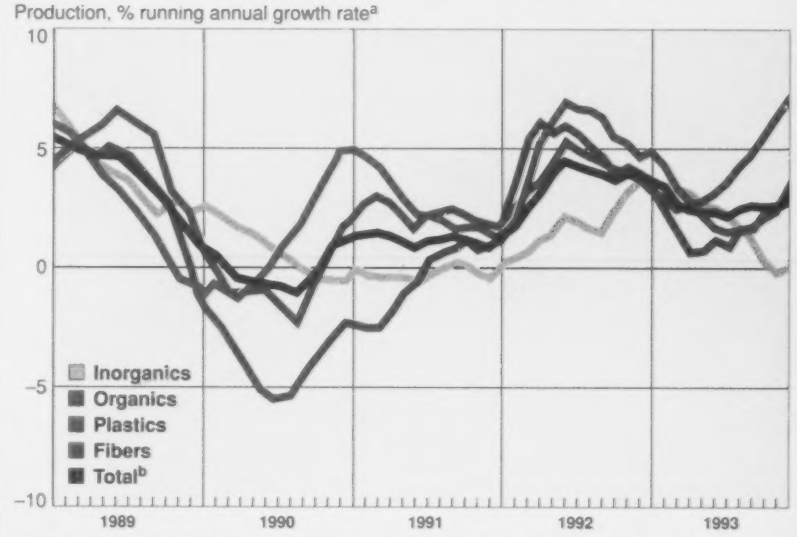
The Federal Reserve Board found output of basic chemicals, which is the board's classification for inorganics, unchanged in 1993, after a 10% rise in 1992. Production in the board's chemical products category—which includes pharmaceuticals, soaps, and paints—grew 3%, as it has annually for a decade.

As might be expected, increased use of methyl *tert*-butyl ether (MTBE) as a gasoline additive continued to send its production soaring. MTBE output more than doubled in 1993 to 24 billion lb, making it the ninth largest volume chemical. Production of MTBE precursor isobutylene rose 20% to 1.1 billion lb.

Production of phosphate rock nosedived 24% in 1993. A decline in exports of phosphate products, especially of diammonium phosphate to China, was responsible for the cutback in output, according to analysts at the Bureau of Mines. Production of diammonium phosphate fell 11% in 1993, according to data from the Fertilizer Institute. U.S. consumption of phosphate fertilizers, on the other hand, rose a healthy 6%.

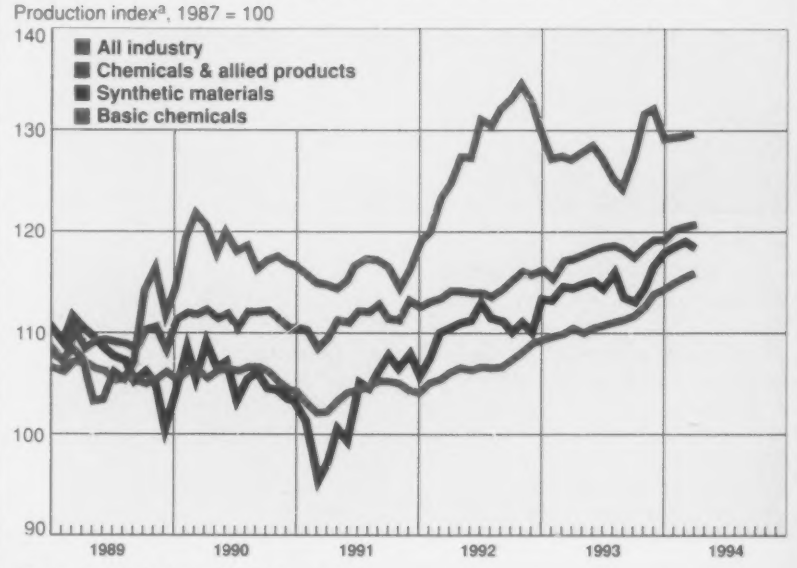
All categories of plastics posted gains in production last year. Output of thermosetting resins rose 8%, with the increase for individual resins varying from 5% for phenolics to 16% for melamines. Production of thermoplastic resins was up 3%.

All chemical sectors, except inorganics, picked up in 1993



a Average running annual growth rates in production of major plastics, inorganic and organic chemicals, and in shipments of man-made fibers. b Average running annual growth rate for products in the above four categories taken as a whole. **Sources:** International Trade Commission, Bureau of the Census, Society of the Plastics Industry, Textile Economics Bureau

Chemicals production posts modest but steady growth



a Seasonally adjusted. **Source:** Federal Reserve Board

TOP 50 CHEMICALS: Strong 9% rise in organics boosted total production 3%

Rank 1993	Rank 1992[a]		Billions of lb 1993	Billions of lb 1992
1	1	Sulfuric acid	80.31	89.72
2	2	Nitrogen	65.29	60.51
3	3	Oxygen	46.52	43.46
4	4	Ethylene	41.25	40.93
5	6	Lime[b]	36.80	35.71
6	5	Ammonia	34.50	36.59
7	8	Sodium hydroxide	25.71	24.50
8	9	Chlorine	24.06	23.51
9	19	Methyl *tert*-butyl ether	24.05	10.88
10	7	Phosphoric acid	23.04	25.58
11	10	Propylene	22.40	23.43
12	11	Sodium carbonate[c]	19.80	20.84
13	15	Ethylene dichloride	17.95	15.15
14	13	Nitric acid	17.07	16.09
15	14	Ammonium nitrate[d]	16.79	15.66
16	12	Urea[e]	15.66	17.96
17	17	Vinyl chloride	13.75	11.31
18	16	Benzene	12.32	11.98[g]
19	18	Ethylbenzene	11.76	11.11
20	19	Carbon dioxide[f]	10.69	10.88
21	23	Methanol	10.54	8.08
22	21	Styrene	10.07	9.00
23	29	Terephthalic acid[g]	7.84	5.64[g]
24	22	Formaldehyde[h]	7.61	8.28
25	25	Xylene	6.84	6.39
26	24	Hydrochloric acid	6.45	7.13
27	27	Toluene[i]	6.38	6.01[g]
28	28	*p*-Xylene	5.76	5.66
29	26	Ethylene oxide	5.68	5.83
30	30	Ethylene glycol	5.23	5.13
31	31	Ammonium sulfate	4.80	4.78
32	32	Cumene	4.49	4.67
33	34	Phenol[j]	3.72	3.71[g]
34	35	Acetic acid	3.66	3.59
35	33	Potash[k]	3.31	3.86
36	38	Propylene oxide	3.30	2.90
37	37	Carbon black	3.22	3.02
38	36	Butadiene[l]	3.09	3.23
39	40	Vinyl acetate	2.83	2.66
40	41	Titanium dioxide	2.56	2.51
41	39	Acrylonitrile	2.51	2.83
42	42	Acetone	2.46	2.43
43	44	Aluminum sulfate	2.23	2.09
44	43	Cyclohexane	2.00	2.24
45	45	Sodium silicate	1.97	1.82
46	46	Adipic acid	1.56	1.56
47	47	Sodium sulfate[m]	1.44	1.52
48	48	Calcium chloride[n]	1.40	1.39
49	49	Caprolactam	1.36	1.38
50	–	*n*-Butyl alcohol	1.33	1.26
		TOTAL ORGANICS	257.38	235.24
		TOTAL INORGANICS	427.95	431.18
		GRAND TOTAL	685.33	666.42

a Revised. b Except refractory dolomite. c Natural and synthetic. d Original solution. e 100% basis. f Liquid and solid only. g Includes both acid and ester without double counting. h 37% by weight. i All grades. j Synthetic only. k K_2O basis. l Rubber grade. m High and low purity. n 75% basis, solid and liquid.

PRODUCTION: Drugs and medicines rose, paints and some inorganics declined

Industrial production indexes, 1987 = 100	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	% annual change 1992–93	% annual change 1983–93
Total index	84.9	92.8	94.4	95.3	100.0	104.4	106.1	106.0	104.1	106.5	110.9	4%	3%
Manufacturing, total	80.9	89.3	91.6	94.3	100.0	104.7	106.4	106.1	103.7	106.8	111.7	5	3
Nondurable manufacturing	87.0	90.8	91.5	94.9	100.0	102.3	103.7	104.4	103.5	106.5	108.7	2	2
Chemicals & products	87.5	91.4	91.4	94.6	100.0	106.0	109.2	111.8	111.4	114.3	117.8	3	3
Chemicals & synthetic materials	88.6	92.8	92.2	93.9	100.0	107.5	112.2	114.5	111.3	114.8	118.6	3	3
Basic chemicals	92.1	96.9	96.1	95.1	100.0	104.7	108.4	118.9	116.0	128.0	128.1	0	3
Alkalies & chlorine	87.9	95.3	93.6	92.1	100.0	104.9	107.4	107.2	104.2	105.4	108.4	3	2
Inorganic pigments	87.3	89.0	95.1	96.2	100.0	111.4	114.0	109.0	101.5	118.2	116.3	–2	3
Inorganic chemicals, nec	94.3	98.0	97.2	94.7	100.0	103.5	107.7	123.8	120.0	133.6	131.4	–2	3
Industrial organic chemicals	89.9	93.4	94.1	95.1	100.0	111.6	117.8	119.4	115.7	111.6	117.0	5	3
Synthetic materials[a]	84.3	88.9	86.9	91.6	100.0	104.3	107.7	105.8	102.9	110.2	114.6	4	3
Plastics materials	74.4	81.1	84.1	88.2	100.0	104.0	106.1	106.7	101.5	108.2	112.4	4	4
Man-made fibers	92.3	93.3	86.6	93.7	100.0	103.5	110.5	102.8	103.3	110.1	114.6	4	2
Chemical products	86.6	89.0	90.2	95.9	100.0	104.7	106.3	108.8	110.9	113.1	116.4	3	3
Drugs & medicines	86.1	86.9	88.5	96.7	100.0	104.9	108.6	112.6	120.6	127.2	134.8	6	5
Soaps & toiletries	91.4	90.6	91.3	96.7	100.0	106.4	107.3	109.4	108.4	106.4	106.7	0	2
Paints	84.6	91.8	95.7	97.5	100.0	103.8	98.9	97.1	91.0	90.6	87.8	–3	0
Agricultural chemicals	87.5	102.0	96.1	88.5	100.0	106.5	115.3	119.3	116.2	122.0	125.8	3	4
Petroleum products	89.6	92.8	92.6	98.9	100.0	101.9	102.3	103.3	101.6	102.7	104.9	2	2
Rubber & plastics products	74.3	83.8	85.8	90.8	100.0	102.6	106.0	107.2	104.5	110.8	115.9	5	5

a Includes synthetic rubber. **nec** = not elsewhere classified. **Source:** Federal Reserve Board

ORGANIC CHEMICALS: Output was up in more cases than down in 1993

Millions of lb unless otherwise noted	Production											% annual change	
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993[a]	1992–93	1983–93
Acetic acid, synthetic	2,807	2,619	2,897	2,728	3,246	3,159	3,294	3,751	3,615	3,594	3,656	2%	3%
Acetone	1,859	1,862	1,788	1,910	1,846	2,303	2,524	2,329	2,347	2,435	2,462	1	3
Acrylonitrile	2,035	2,146	2,219	2,349	2,182	2,452	2,609	2,676	2,647	2,829	2,508	–11	2
Aniline	663	786	716	824	829	1,029	1,016	989	996[a]	1,009	1,011	0	4
Benzene, mg[b,c]	1,232	1,318	1,283	1,362	1,575	1,608	1,631	1,699	1,569	1,636[a]	1,677	3	3
Bisphenol A	643	762	949	956	1,000	1,340	1,241	1,149	1,181[a]	1,197	1,286	7	7
1,3-Butadiene[d]	2,353	2,452	2,340	2,546	2,931	3,169	3,121	3,088	3,054	3,232	3,092	–4	3
1-Butanol	833	908	716	881	1,155	1,194	1,751	1,269	1,320	1,279	1,328	4	5
Caprolactam	977	1,027	1,089	1,109	1,156	1,261	1,307	1,379	1,284	1,377	1,359	1	3
Carbon tetrachloride	573	713	646	627	672	761	na	413	315	na	na	—	—
Chloroform	362	405	275	422	462	524	588	484	505	na	476	—	3
Cumene	3,345	3,754	2,627	3,745	4,105	4,455	4,426	4,311	4,284[a]	4,666	4,489	–4	3
Cyclohexane	1,656	1,994	1,657	2,070	2,276	2,297	2,273	2,460	2,307	2,242	2,000	–11	1
Dioctyl phthalate	300	301	275	296	343	344	306	310	270	270	245	–9	–2
Ethanol, synthetic	1,077	1,060	649	529	574	562	549	546	526	698	740	6	–4
Ethanolamines[e]	468	504	537	543	627	608	667	727	658	694[a]	706	2	4
Ethylbenzene	7,876	7,562	7,386	9,020	9,346	9,929	9,235	8,369	11,446[a]	11,108	11,758	6	4
Ethyl chloride	282	290	171	164	155	152	162	149	na	na	na	—	—
Ethylene	28,680	31,383	29,847	32,859	34,951	37,204	34,988	36,467	39,955	40,924	41,244	1	4
Ethylene dichloride	11,506	10,710	12,101	12,940	12,197	13,028	13,383	13,849	13,713	15,150	17,945	18	5
Ethylene glycol	4,425	4,823	4,178	4,771	5,183	5,517	5,461	5,070	4,809	5,128	5,228	2	2
Ethylene oxide	5,534	5,699	5,430	5,430	4,785	5,953	5,031	5,355	5,248	5,829	5,684	2	2
2-Ethylhexanol	387	541	536	571	662	743	612	650	657	692	688	–1	6
Formaldehyde, 37%[f]	5,465	5,815	5,606	5,549	5,733	6,280	5,893	6,720	6,612	8,278	7,604	–8	4
Isobutylene	760	883	na	1,124	1,035	1,244	1,193	1,212	972	952	1,146	20	4
Isopropyl alcohol	1,209	1,394	1,235	1,301	1,371	1,389	1,474	1,456	1,342	1,463	1,236	–15	0
Maleic anhydride	299	359	394	359	382	448	475	424	381	436	424	–3	4
Methanol, synthetic	7,982	8,186	5,003	7,205	7,537	8,142	8,167	8,344	8,704	8,082	10,542	30	3
Methyl *tert*-butyl ether	839	1,376	1,891	3,375	3,514	5,680	8,227	8,884	9,570[g]	10,877[g]	24,053[g]	121	40
Methyl chloride	409	482	410	605	373	597	461	772	916	966	849	–12	8
Methyl ethyl ketone	531	543	537	600	672	482	450	465	513	479	556	16	1
Methyl methacrylate	844	917	858	943	1,029	1,100	1,161	1,182	1,102	1,208	1,088	–10	3
Methylchloroform	586	675	869	652	694	724	783	803	644	692	452	–35	–3
Methylene chloride	584	607	467	566	516	504	482	461	389	362	354	–2	–5
Perchloroethylene	547	573	678	414	473	498	481	372	239	245	271	11	–7
Phenol, synthetic[h]	2,638	2,889	2,841	3,115	3,351	3,562	3,806	3,538	3,484[a]	3,707[a]	3,718	0	3
Phthalic anhydride	838	870	820	863	1,035	999	917	940	874[a]	898	854	–5	0
Propylene[i]	13,959	15,559	14,887	16,522	19,019	21,224	20,571	21,846	21,549	23,421	22,398	4	5
Propylene glycol	484	462	500	573	747	840	805	754	666	509	885	74	6
Styrene	6,802	7,709	7,622	7,888	8,014	8,984	8,337	8,017	9,003[a]	9,000	10,063	–12	4
Terephthalic acid, dimethyl ester[j]	5,626	5,912	6,490	6,257	7,601	10,234	8,426	7,773	7,654[a]	5,637[a]	7,837	–28	3
Toluene, mg[b,k]	780	728	698	611	967	892	806	861	873	833[a]	833	6	1
Vinyl acetate	1,963	2,024	2,112	1,710	1,813	2,561	2,552	2,659	2,732	2,657	2,827	6	4
Vinyl chloride	6,875	6,084	9,463	8,439	8,402	9,058	10,135	10,623	11,142	11,307	13,746	–22	7
***o*-Xylene**	781	688	675	788	940	971	983	943	935[a]	918	884	–4	1
***p*-Xylene**	4,114	4,264	4,779	5,035	5,155	5,601	5,344	5,200	5,431[a]	5,656	5,757	2	3

Note: In 1992, the International Trade Commission changed its format for presenting revised data in its annual synthetic organic chemicals report to conform to the format of the Harmonized Tariff Schedule (HTS) of the U.S. For this reason, revised data for 1992 for some organic chemicals—in this table benzene, phenol, terephthalic acid, and toluene—are not comparable with either revised data for previous years or preliminary data for 1993. Thus, preliminary data for 1992, which are comparable, are reported for these chemicals. **mg** = millions of gallons. **a** Preliminary, calculated from quarterly data. **b** Tar distillers and coke-oven operators not included. **c** Specification grades. **d** Rubber grade. **e** Mono-, di-, and triethanolamines. **f** By weight. **g** C&EN estimate. **h** Does not include data for coke ovens and gas-retort ovens. **i** All grades. **j** Includes both acid and dimethyl ester (DMT), without double counting. **k** All grades, includes material used in blending motor fuel. **na** = not available. **Source:** International Trade Commission

INORGANIC CHEMICALS: Largest volume product, sulfuric acid, fell 10% in year of mixed results

Thousands of tons unless otherwise noted	Production											% annual change	
	1983	1984	1985	1986	1987	1988	1989	1990	1991[r]	1992	1993[a]	1992–93	1983–93
Aluminum sulfate[b]	1,119	1,129	1,268	1,222	1,227	1,237	1,243	1,227	1,185	1,047	1,113	6%	0%
Ammonia, 100%[c,d]	14,072	16,692	17,319	14,487	16,098	16,821	16,468	17,003	17,169	18,295	17,252	–6	2
Ammonium nitrate, 100%[e]	6,240	7,146	7,149	6,091	6,547	7,504	7,871	7,713	7,819	7,832	8,394	7	3
Ammonium sulfate, 100%[f]	1,956	2,067	2,093	2,080	2,189	2,333	2,384	2,519	2,243	2,391	2,398	0	2
Chlorine gas[g]	9,960	10,700	10,402	10,436	11,078	11,257	11,413	11,809	11,421	11,757	12,028	2	2
Hydrochloric acid, 100%[h]	2,468	2,732	2,807	2,413	2,996	3,228	3,268	3,140	3,301	3,567	3,224	–10	3
Hydrogen, bcf, 100%[i,j]	103	109	121	136	173	177	146	148	153	161	178	11	6
Hydrogen peroxide, 100%[k]	117	139	144	152	153	168	204	238	254	na	na	na	na
Nitric acid, 100%[k]	6,768	7,726	7,631	6,734	7,225	7,991	8,349	7,932	7,927	8,043	8,537	6	2
Nitrogen gas, bcf, 100%[i,j]	560	661	665	677	685	722	744	749	770	835	901	8	5
Oxygen, bcf, 100%[i,j]	346	375	393	383	405	452	460	462	470	525	562	7	5
Phosphoric acid, 100% P_2O_5	9,767	11,370	10,607	9,578	10,599	11,659	11,737	12,035	12,109	12,792	11,521	–10	2
Phosphorus[m]	366	386	359	364	344	343	353	346	306	271	267	–1	–3
Sodium chlorate, 100%	323	295	259	267	289	267	290	327	449	554	544	–2	5
Sodium hydroxide, 100%	10,039	10,914	10,811	10,691	11,553	10,533	11,470	12,030	11,713	12,249	12,854	5	3
Sodium phosphate[n]	669	675	625	617	586	549	610[o]	497	462	na	na	na	na
Sodium silicate[p]	710	685	692	791	952	812	833	816	870	912	983	8	3
Sodium sulfate, 100%[q]	914	901	1,203	837	799	819	755	786	794	761	718	–6	–2
Sulfuric acid, 100%[r]	36,583	41,802	39,890	35,993	39,256	42,580	43,301	44,337	43,466	44,860	40,153	–10	1
Titanium dioxide, 100%[s]	760	835	860	931	968	1,022	1,101	1,077	1,095	1,253	1,280	2	5
Urea	6,137	7,433	6,975	6,264	7,433	7,914	8,004	8,216	8,133	8,981	7,832	–13	2

Note: bcf = billions of cubic feet. **a** Preliminary. **b** Commercial, 17% Al_2O_3, includes municipalities. **c** Synthetic anhydrous. **d** Excludes by-product ammonia liquor and ammonium sulfate. **e** Original solution. **f** Synthetic and noncoke by-product. **g** Includes quantities liquefied for use, storage, or shipment. **h** Includes anhydrous hydrochloric acid production. **i** High- and low-purity gas. **j** Liquid and gas; excludes amounts vented and used as fuel, and amounts produced in petroleum refineries for captive use. **k** Includes unspecified amounts produced but not withdrawn from the system. **l** Excludes amounts produced and consumed in making synthetic ammonia or ammonia derivatives. **m** Elemental, white (yellow), and red (technical). **n** Tripolyphosphate (100% $Na_5P_3O_{10}$). **o** Includes tetrabasic (pyro) phosphate. **p** Soluble silicate glass (water glass), solid and liquid (anhydrous); excludes amounts produced and consumed in making meta-, ortho-, and sesquisilicates. **q** Anhydrous, high and low purity, and Glauber's salt. **r** Gross (new and fortified). **s** Composite and pure. **na** = not available. **Sources:** Department of Commerce, Bureau of the Census

MINERALS: Phosphate rock production tumbled 24%, potash output dropped 12%

Thousands of tons	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993[a]	% annual change 1992–93	% annual change 1983–93
Bromine, sold or used[b]	185	193	160	155	168	180	193	195	187	183	185	1%	0%
Calcium chloride, production[c]	912	1,036[d]	940	780	658	677	628[d]	691[d]	620[d]	821[d]	na	na	na
Lime, production[e]	14,867	15,922	15,690	14,474	15,733	17,052	17,152	17,452	17,270[d]	17,857	18,427	3	2
Lithium, consumption[d,f]	2.2	3.2	2.5	2.6	2.6	3.0	3.0	3.0	2.9	2.5	2.8	12	2
Phosphate rock													
Production	46,928	54,230	56,035	44,445	45,144	50,032	54,913	51,084	53,016	51,770	39,125	–24	–2
Exports	13,239	12,707	10,071	8,651	9,319	8,920	8,644	6,876	5,602	4,104	3,525	–14	–12
Potash (K_2O equivalent)[g]													
Production	1,575	1,724	1,429	1,325	1,391	1,677	1,758	1,888	1,928	1,879	1,653[d]	–12	0
Imports	4,894	5,323	5,063	4,643	4,490	4,648	3,758	4,590	4,990	4,683	4,809[d]	3	0
Apparent consumption[h]	6,231	6,638	5,893	5,338	5,609	5,803	4,960	6,011	6,186	5,898	5,988[d]	2	0
Sodium carbonate, production[i]	8,467	8,511	8,511	8,438	8,891	9,632	9,915	10,093	9,926	10,338	9,878	–4	2
Sulfur, production[j]	10,240	11,742	12,797	12,221	11,616	11,845	12,778	12,743	11,928	11,759	11,684[d]	–1	1
Recovered elemental	5,462	5,747	5,857	6,411	6,791	7,103	7,176	7,205	7,326	7,769	7,826[d]	1	4
Frasch	3,530	4,622	5,524	4,457	3,530	3,499	4,286	4,107	3,162	2,557	2,425[d]	–5	–4
Other production	1,249	1,372	1,416	1,354	1,296	1,243	1,316	1,431	1,440	1,433	1,433[d]	0	1
Apparent consumption[h]	12,112	13,976	13,192	11,669	12,481	14,012	13,983	14,392	14,255	14,056	13,889[d]	–1	1

a Preliminary data, except those for phosphate rock. **b** Elemental bromine sold as such or used in preparation of bromine compounds by primary producers. **c** 75% $CaCl_2$ equivalent. **d** Estimated. **e** Sold or used by producers for commercial or captive use. Produced from limestone and dolomite; does not include amount regenerated by paper industry; excludes Puerto Rican production. **f** Lithium content basis. **g** Includes muriate and sulfate of potash, potassium magnesium sulfate, and parent salts; excludes other chemical compounds containing potassium. **h** Calculated from shipments plus imports minus exports. **i** Natural and synthetic until 1986, natural only in 1987–92. **j** Sulfur content basis. **na** = not available. **Sources:** Bureau of Mines, Bureau of the Census

PLASTICS: Strong year for thermosets, thermoplastics gain as well

Millions of lb[a]	Production											% annual change	
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1992–93	1983–93
THERMOSETTING RESINS													
Epoxy[b]	334	406	385	398	433	486	509	499	497	457	510	12%	4%
Melamine	180	210	192	173	212	207	222	202	196	232	270	16	4
Phenolic[c,d]	2,477	2,502	2,621	2,735	2,869	3,066	2,879	2,946	2,658	2,923	3,078	5	2
Polyester[e]	1,084	1,232	1,223	1,271	1,367	1,404	1,319	1,221	1,075	1,175	1,264	8	2
Urea	1,172	1,199	1,210	1,271	1,382	1,425	1,477	1,496	1,483	1,548	1,743	13	4
TOTAL	**5,247**	**5,549**	**5,631**	**5,848**	**6,263**	**6,588**	**6,408**	**6,364**	**5,909**	**6,335**	**6,865**	**8%**	**3%**
THERMOPLASTIC RESINS													
Polyethylene													
Low density[f]	8,041	8,413	8,889	8,903	9,599	10,397	9,695	11,148	11,582	11,917	12,044	1%	4%
High density[g]	5,689	6,085	6,671	7,182	7,995	8,400	8,102	8,337	9,213	9,808	9,912	1	6
Polypropylene	4,433	4,940	5,139	5,812	6,647	7,274	7,238	8,310	8,330	8,421	8,614	2	7
Styrene polymers													
Polystyrene	3,570	3,838	4,054	4,470	4,780	5,187	5,104	5,021	4,954	5,096	5,367	5	4
Styrene-acrylonitrile	93	99	87	92	126	148	113	135	109	113	105	–7	1
Acrylonitrile-butadiene-styrene and other styrene polymers[h]	1,889	2,127	2,036	2,196	2,254	2,418	2,394	2,351	2,287	2,610	2,920	12	4
Polyamide, nylon type	321	396	399	465	507	566	569	558	576	668	768	15	9
Polyvinyl chloride and copolymers	6,067	6,760	6,772	7,256	7,971	8,350	8,478	9,096	9,164	9,989	10,257	3	5
Thermoplastic polyester	778	899	965	1,175	1,394	1,652	1,630	1,879	2,115	2,413	2,536	5	12
TOTAL	**30,881**	**33,557**	**35,012**	**37,551**	**41,273**	**44,392**	**43,323**	**46,835**	**48,330**	**51,035**	**52,524**	**3%**	**6%**

Note: Totals are for those products listed and exclude some small-volume plastics. **a** Dry-weight basis unless otherwise specified. **b** Unmodified. **c** Includes other tar-acid resins. **d** Gross-weight basis. **e** Unsaturated. **f** Density 0.940 and below. **g** Density above 0.940. **h** Includes styrene-butadiene copolymers and other styrene-based polymers. **Source:** Society of the Plastics Industry

SYNTHETIC RUBBER: Shipments rose 3% in 1993, continuing previous year's upswing

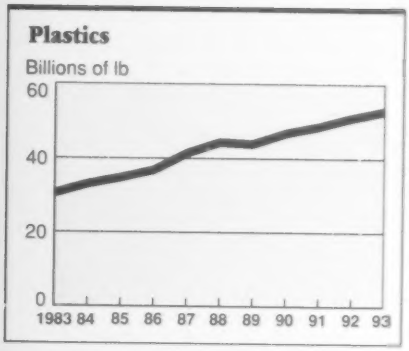
Thousands of metric tons	Shipments[a]											% annual change	
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1992–93	1983–93
Styrene-butadiene rubber	881	888	753	736	847	829	827	791	727	796	817	3%	–1%
Polybutadiene	391	433	392	384	414	430	427	431	416	463	473	2	2
Ethylene-propylene	155	185	174	188	205	224	225	208	192	206	227	10	4
Nitrile-solid	56	65	58	64	72	75	72	69	71	74	78	5	3
Polychloroprene	88	93	82	82	81	82	79	79	70	72	70	–3	–2
Other[b]	303	323	289	310	336	355	295	329	298	315	328	4	1
TOTAL	**1,874**	**1,987**	**1,748**	**1,764**	**1,955**	**1,995**	**1,925**	**1,907**	**1,774**	**1,926**	**1,993**	**3%**	**1%**

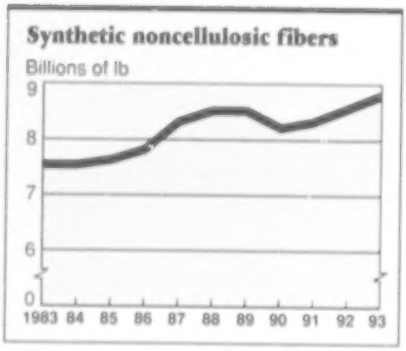
a Includes Canada. **b** Includes butyl styrene-butadiene rubber latex, nitrile latex, polyisoprene, and miscellaneous others. **Source:** International Institute of Synthetic Rubber Producers

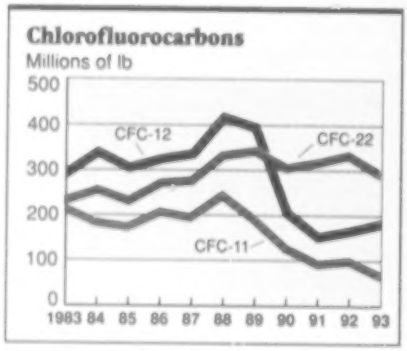
SYNTHETIC FIBERS: Nylon, olefin posted healthy gains, acrylic fell for ninth consecutive year

Millions of lb	Production											% annual change	
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1992–93	1983–93
NONCELLULOSIC FIBERS													
Acrylic[a]	671	671	631	616	592	588	543	506	454	439	433	–1%	–4%
Nylon	2,419	2,412	2,343	2,514	2,689	2,669	2,740	2,662	2,535	2,556	2,664	4	1
Olefin[b]	906	997	1,249	1,393	1,494	1,588	1,639	1,822	1,866	2,002	2,138	7	2
Polyester	3,544	3,392	3,341	3,305	3,541	3,681	3,594	3,195	3,411	3,576	3,557	–1	0
CELLULOSIC FIBERS													
Acetate[c]	229	199	558	619	605	614	580	505	486	495	505	2	–2
Rayon	401	421											
TOTAL	**8,168**	**8,092**	**8,122**	**8,447**	**8,921**	**9,140**	**9,096**	**8,690**	**8,752**	**9,068**	**9,297**	**3%**	**1%**

a Includes modacrylic. **b** Includes olefin yarn and monofilaments and olefin and vinyon staple, tow, and fiberfill. **c** Includes diacetate and triacetate; excludes production for cigarette filters. **Source:** Fiber Economics Bureau







PAINTS AND COATINGS: Shipments for architectural uses grew fastest in year of steady expansion

Millions of gal	Shipments											% annual change	
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993[a]	1992–93	1983–93
Architectural	433	457	478	498	527	536	537	557	538	562	586	4%	3%
Product[b]	294	336	352	368	340	364	360	346	320	334	342	2	2
Special purpose	130	145	145	135	146	154	179	197	180	169	172	2	3
TOTAL	857	938	975	1,001	1,013	1,054	1,076	1,100	1,038	1,065	1,100	3%	3%

a Calculated from quarterly data. b For original equipment manufacturers. **Source:** Department of Commerce

AEROSOLS: Production decreased 2% in 1993 as volume fell for many end uses

Millions of units	Production[a]											% annual change	
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1992–93	1983–93
Personal products	747	832	879	952	964	1,100	1,015	1,050	905	990	930	–6%	2%
Household products	586	603	630	635	640	650	680	680	690	695	738	6	2
Automotive & industrial products	303	337	342	375	379	440	475	415	450	455	420	–8	3
Paints and finishes	300	307	290	297	307	331	350	350	350	380	390	3	3
Insect sprays	180	184	190	193	190	190	197	190	200	200	207	4	1
Food products	132	138	140	136	140	157	175	175	192	190	205	8	–4
Animal products	19	16	15	22	22	8	8	8	8	8	6	–25	–11
Miscellaneous	15	15	23	18	80	31	12	15	19	71	44	–38	11
TOTAL	2,282	2,432	2,509	2,628	2,722	2,907	2,912	2,883	2,814	2,989	2,940	–2%	3%

a Includes Puerto Rican production. **Source:** Chemical Specialties Manufacturers Association

CHLOROFLUOROCARBONS: CFC-12 rose 13% as other nonhydrogenated products dropped

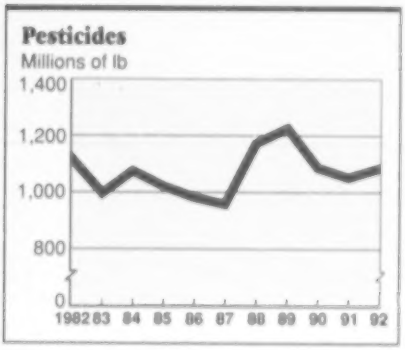
Millions of lb	Production											% annual change	
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993[a]	1992–93	1983–93
Chlorodifluoromethane (CFC-22)	236	254	235	271	275	333	343	306	314	330	291	–12%	2%
Dichlorodifluoromethane (CFC-12)	290	337	302	322	335	414	392	209	157	163	185	13	–4
Trichlorofluoromethane (CFC-11)	215	185	176	202	198	249	192	135	99	100[a]	72	–28	–10
All other fluorinated hydrocarbons[b]	279	337	306	344	354	379	385	na	239	na	na	—	—
TOTAL	1,020	1,113	1,019	1,139	1,162	1,374	1,312	na	809	na	na	—	—

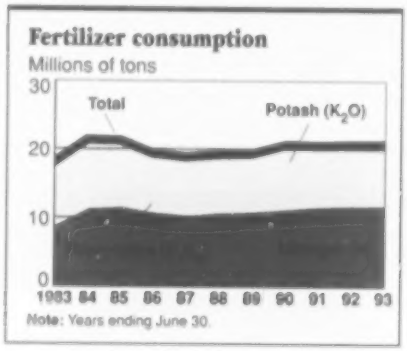
a Preliminary. b Includes other fluorohalogenated hydrocarbons. **na** = not available. **Source:** International Trade Commission

PESTICIDES: Herbicides and insecticides production recovered in 1992

Millions of lb	Production											% annual change	
	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1991–92	1982–92
Herbicides	734	587	688	647	625	623	676	676	643	657	696	6%	–1%
Insecticides	229	206	211	213	204	185	203	208	264[a]	181	190	5	–2
Nematicides	71[b]	76[b]	53[b]	50[b]	66	76	85	112	67[b]	72	71[b]	–1	0
Fungicides	77	43	78	75	70	62	193[a]	207[a]	85	na	85	—	1
Plant growth regulators	9[b]	5[b]	8	8	5	2[b]	4	5[b]	6[b]	17	12	–3	—
TOTAL[c]	**1,137**	**975**	**1,074**	**1,014**	**982**	**964**	**1,183[a]**	**1,222[a]**	**1,093[a]**	**1,054**	**1,083**	**3%**	**0%**

a These seemingly anomalous values have been verified by the source. b Does not include production intended for sale outside the U.S., which is included in annual total. c Includes miscellaneous other pesticides and, in some cases, production, usually intended for sale outside the U.S., not reported by subcategory. na = not available.
Source: National Agricultural Chemicals Association





FERTILIZER CONSUMPTION: Use of phosphates grew substantially last year

Thousands of tons	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	% annual change 1992–93	% annual change 1983–93
Nitrogen (N)	9,127	11,092	11,493	10,424	10,210	10,512	10,593	11,076	11,287	11,446	11,358	–1%	2%
Phosphates (P_2O_5)	4,138	4,901	4,658	4,178	4,008	4,129	4,117	4,345	4,201	4,218	4,458	6	1
Potash (K_2O)	4,831	5,797	5,553	5,053	4,837	4,973	4,838	5,203	5,001	5,042	5,110	1	1
TOTAL	**18,096**	**21,790**	**21,704**	**19,655**	**19,055**	**19,614**	**19,548**	**20,624**	**20,489**	**20,706**	**20,926**	**1%**	**1%**

Note: Years ending June 30. **Source:** Fertilizer Institute

FERTILIZER PRODUCTION: Phosphate rock plunged 24% in dismal year for major products

Thousands of tons	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	% annual change 1992–93	% annual change 1983–93
NITROGEN PRODUCTS													
Ammonia	13,361	16,613	16,594	12,565	13,357	14,136	14,052	14,446	13,790	13,309	12,587	–5%	–1%
Ammonium nitrate	3,232	3,365	3,178	2,250	2,472	2,765	2,703	2,579	2,551	2,487	2,700	9	–2
Ammonium sulfate	1,969	2,078	2,343	2,058	2,153	2,260	2,327	2,460	2,195	2,342	2,379	2	2
Urea	4,112	4,889	3,975	3,564	4,253	4,501	4,430	4,287	4,241	4,164	3,863	–7	–1
PHOSPHATE PRODUCTS													
Diammonium phosphate	10,264	12,358	10,800	7,492	9,537	11,575	13,160	13,226	13,573	14,119	12,635	–11	2
Monoammonium phosphate	1,423	1,654	1,641	1,416	1,679	1,818	1,862	2,252	2,227	2,342	2,693	15	7
Concentrated superphosphate	2,684	2,404	2,570	2,127	2,049	2,032	1,777	1,988	1,914	2,074	na	—	—
Phosphate rock	40,664	47,465	49,348	36,227	39,330	42,220	47,676	44,269	44,877	45,941	34,800	–24	–2
Phosphoric acid (P_2O_5)	9,182	10,899	9,837	8,085	8,903	10,234	10,742	11,036	10,934	11,354	10,348	–9	1
POTASH PRODUCTS													
Potassium chloride	1,928	2,168	1,713	1,715	1,810	2,243	2,316	2,351	2,387	2,337	1,927	–18	0

Note: Figures are based on Fertilizer Institute surveys and may not represent the entire industry. na = not available. **Source:** Fertilizer Institute

Chemical industry begins to recover

At last, the U.S. chemical industry has had a reasonable year. Although 1993 will not go down in history as a particularly good year for chemical makers, it was the first year since 1988 in which the industry increased earnings over the previous year. Earnings and profitability are nowhere near the levels they were in the late 1980s, but the industry once again appears to be growing.

The upward move came after four years of sagging performance for the industry during which earnings plummeted more than 40% and various measures of profitability fell dramatically. The result was a massive contraction of chemical employment and cuts in capital spending. The reason for capital spending cuts was easy to see—major markets had turned down, so there was no need to increase production capacity.

Now, however, many of these same markets are growing once again: Motor vehicles and housing, both big users of chemical products, are prime examples. As a result, chemical companies in 1993 began to see business increase. Since these companies have spent the past few years cutting costs, especially in white-collar employment, earnings were high. For instance, in 1993, sales increased only about 2% for the 30 major chemical companies C&EN regularly monitors, while earnings rose a much greater 8%. Thanks to the earnings increase, profit margins for the group rose to 5.3% from 5% in 1992, and return on stockholders equity increased to 12.4% from 12.0%.

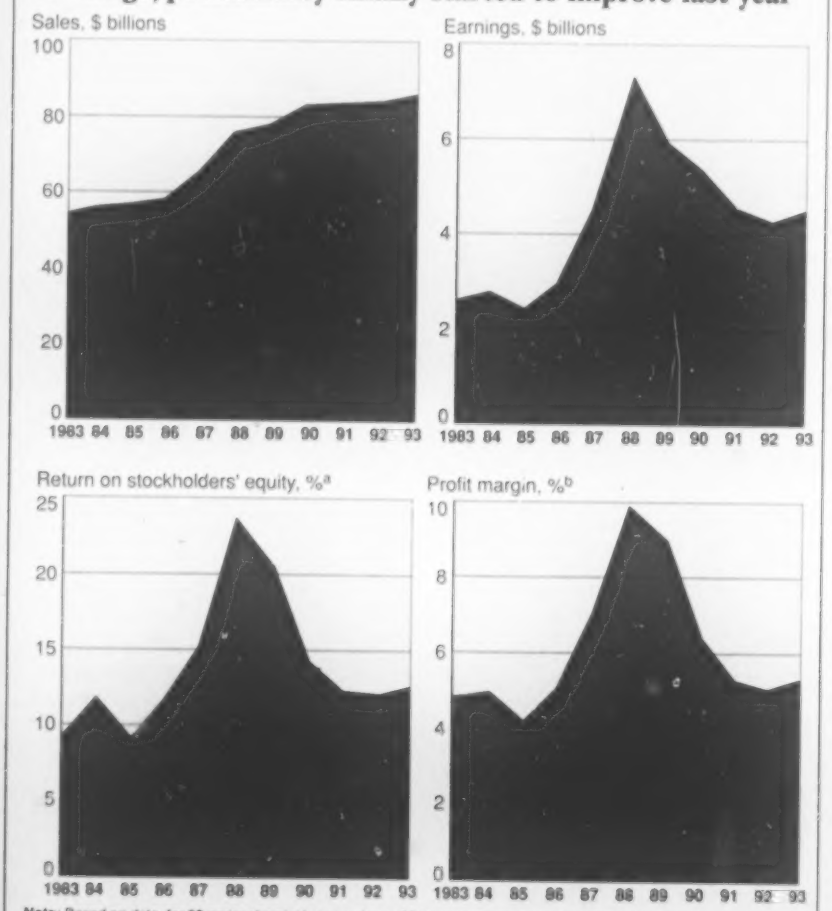
Further evidence that the earnings growth was caused as much by cutting costs as by growing markets can be found in several other measures of industry performance. Shipments of chemicals and allied products increased just 4% for the year, and demand for industrial chemicals rose only 3%. Pricing was anything but good. The government's producer price index for chemicals and allied products increased 2% from the year before, but most of this increase came from drugs and pharmaceuticals, up 5% for the year. Other more basic chemical sectors showed little or no change.

However, these lackluster indicators are not necessarily bad news for the industry's future. If chemical companies can manage an average 8% earnings increase with the price and demand situations that prevailed in 1993, all they need is to have a small rise in prices to begin reaping greater returns.

In fact, Wall Street's financial community is betting on better days to come. Chemical stock prices set new record highs in 1993 and continue to rise this year, indicating that investors believe there is still plenty of room for improvement in the chemical industry.

But there are danger signals for a chemical recovery. Chief among these are interest rate increases that may slow demand for housing and automobiles. The recent decline of the dollar may force further rate increases as the U.S. tries to bolster its currency and fight inflation coming from higher priced imports.

Earnings, profitability finally started to improve last year



Note: Based on data for 30 major chemical companies. **a** After-tax earnings as a percentage of year-end stockholders' equity. **b** After-tax earnings as a percentage of sales.

TOP 100 CHEMICAL PRODUCERS: Most of the largest companies saw big gains in profits in 1993

Rank 1993	Rank 1992		Chemical sales 1993 ($ millions)	Change from 1992	Chemical sales as % of total sales	Industry classification	Chemical operating profits[a] ($ millions)	Change from 1992	Chemical operating profits as % of total profits	Operating profit margin[b]	Identifiable chemical assets ($ millions)	Chemical assets as % of total assets	Operating return on chemical assets[c]
1	1	DuPont	$15,603	0.4%	42.1%	Diversified	$750	–45.9%	51.7%	4.8%	$13,957	45.1%	5.4%
2	2	Dow Chemical	12,524	–3.1	69.3	Basic chemicals	773	30.6	53.7	6.2	12,530	49.1	6.2
3	3	Exxon	10,024	–5.7	9.2	Petroleum	638	–3.3	7.6	6.4	8,478	10.1	7.5
4	4	Hoechst Celanese	6,347	–2.3	92.0	Basic chemicals	561	26.9	155.8	8.8	na	na	na
5	5	Monsanto	5,651	5.0	71.5	Basic chemicals	731	17.5	90.2	12.9	5,312	61.5	13.8
6	7	General Electric[d]	5,042	3.9	8.3	Diversified	834	12.7	12.7	16.5	8,181	3.3	10.2
7	6	Union Carbide	4,640	–4.8	100.0	Basic chemicals	354	12.0	100.0	7.6	4,419	100.0	8.0
8	8	Occidental Petroleum	4,065	–3.8	47.6	Petroleum	184	100.0	84.8	4.5	5,780	33.8	3.2
9	9	BASF	4,037	–0.3	77.6	Basic chemicals	na	na	na	na	na	na	na
10	10	Eastman Chemical	3,903	2.4	100.0	Basic chemicals	476	–5.7	100.0	12.2	4,341	100.0	11.0
11	14	Shell Oil	3,875	18.2	18.6	Petroleum	328	89.6	23.0	8.5	4,312	16.1	7.6
12	12	Amoco	3,773	2.2	13.2	Petroleum	321	def	10.5	8.5	3,938	13.8	8.5
13	—	ICI Americas	3,565	20.0	100.0	Basic chemicals	188	45.7	100.0	5.3	na	na	na
14	11	Mobil	3,533	–4.6	5.5	Petroleum	25	–82.4	0.5	0.7	3,451	8.5	0.7
15	16	Rohm and Haas	3,269	6.7	100.0	Basic chemicals	267	–21.9	100.0	8.2	3,200	100.0	8.3
16	15	Arco Chemical	3,192	3.0	100.0	Basic chemicals	425	–7.0	100.0	13.3	3,502	100.0	12.1
17	19	Miles	3,053	4.7	47.3	Diversified	na	na	na	na	na	na	na
18	18	Air Products[e]	2,906	3.6	87.3	Basic chemicals	417	–16.6	113.0	14.3	3,646	87.5	11.4
19	13	W. R. Grace	2,895	–16.7	65.7	Specialty chemicals	392	–9.9	103.2	13.5	2,115	39.5	18.5
20	21	AlliedSignal	2,791	7.3	23.6	Diversified	309	26.1	32.4	11.1	2,502	23.1	12.4
21	17	Chevron	2,708	–5.7	7.5	Petroleum	225	94.0	8.2	8.3	2,457	7.1	9.2
22	23	Ashland Oil[e]	2,586	3.9	25.4	Petroleum	108	12.5	36.4	4.2	958	17.3	11.3
23	22	Ciba	2,519	–0.2	55.2	Specialty chemicals	na	na	na	na	na	na	na
24	20	Praxair	2,438	–6.4	100.0	Basic chemicals	341	23.6	100.0	14.0	3,255	100.0	10.5
25	26	Phillips Petroleum	2,308	3.7	18.8	Petroleum	97	148.7	9.1	4.2	2,011	18.5	4.8
26	27	Akzo	2,241	11.7	100.0	Basic chemicals	196	28.9	100.0	8.8	na	na	na
27	25	Rhône-Poulenc	2,200	–4.3	100.0	Specialty chemicals	na	na	na	na	na	na	na
28	29	Dow Corning	2,044	4.5	100.0	Specialty chemicals	236	11.9	100.0	11.5	3,265	100.0	7.2
29	35	Ethyl	1,938	14.5	100.0	Basic chemicals	168	–22.9	100.0	8.6	2,009	100.0	8.3
30	—	Huntsman Chemical	1,850	15.6	100.0	Basic chemicals	na	na	na	na	na	na	na
31	28	Hercules	1,843	–12.7	66.5	Basic chemicals	252	1.2	81.8	13.7	1,375	61.0	18.3
32	31	FMC	1,837	1.0	48.9	Machinery	197	–7.5	52.5	10.7	1,522	54.1	13.0
33	30	National Starch	1,808	–1.0	100.0	Specialty chemicals	288	3.3	100.0	15.9	1,672	100.0	17.2
34	36	Great Lakes Chemical	1,792	19.7	100.0	Specialty chemicals	415	15.0	100.0	23.2	1,901	100.0	21.8
35	34	Elf Atochem	1,700	0	100.0	Basic chemicals	na	na	na	na	na	na	na
36	38	Lubrizol	1,526	6.4	100.0	Specialty chemicals	190	2.6	100.0	12.5	1,055	89.2	18.0
37	24	American Cyanamid[d]	1,411	8.5	33.0	Specialty chemicals	na	na	na	na	na	na	na
38	40	Nalco Chemical	1,389	1.1	100.0	Specialty chemicals	263	1.0	100.0	18.9	1,212	100.0	21.7
39	39	Lyondell Petrochemical	1,326	–5.9	34.4	Petroleum products	57	–58.7	61.3	4.3	688	55.9	8.3
40	42	Morton International[f]	1,274	3.2	55.2	Specialty chemicals	135	–18.1	42.9	10.6	1,273	56.8	10.6
41	58	Witco	1,233	47.3	57.5	Specialty chemicals	108	45.7	94.5	8.8	1,037	56.4	10.4
42	45	Solvay America	1,200	4.4	100.0	Basic chemicals	na	na	na	na	na	na	na
43	44	Cabot[e]	1,192	0.9	73.8	Basic chemicals	149	–3.8	89.9	12.5	1,117	75.0	13.3
44	46	International Flavors	1,189	5.5	100.0	Specialty chemicals	311	16.0	100.0	26.2	1,225	100.0	25.4
45	47	PPG Industries	1,150	3.4	20.0	Glass products	138	–25.4	18.5	12.0	1,092	19.3	12.6
46	49	Olin	1,117	12.1	46.1	Basic chemicals	na	na	na	na	na	na	na
47	37	Texaco	1,114	–23.9	3.2	Petroleum	na	na	na	na	na	na	na
48	41	BP America	1,038	–19.8	6.6	Petroleum	26	–59.4	1.8	2.5	na	na	na
49	52	Henkel	1,010	14.6	100.0	Specialty chemicals	na	na	na	na	na	na	na
50	—	Cytec	1,008	–3.5	100.0	Basic chemicals	na	na	na	na	na	na	na

Rank 1993	Rank 1992		Chemical sales 1993 ($ millions)	Change from 1992	Chemical sales as % of total sales	Industry classification	Chemical operating profits[a] ($ millions)	Change from 1992	Chemical operating profits as % of total profits	Operating profit margin[b]	Identifiable chemical assets ($ millions)	Chemical assets as % of total assets	Operating return on chemical assets[c]
51	52	H. B. Fuller[g]	$975	4.5%	100.0%	Specialty chemicals	$54	–25.1%	100.0%	5.5%	$565	100.0%	9.5%
52	—	Geon	973	8.7	100.0	Basic chemicals	24	–384.7	100.0	2.5	721	100.0	3.4
53	50	Tenneco	914	–3.9	6.9	Diversified	83	6.4	6.7	9.1	721	4.7	11.5
54	—	Hanson	911	12.2	12.6	Diversified	na	na	na	na	na	na	na
55	51	Engelhard	910	–4.1	42.3	Diversified	137	7.2	81.5	15.0	788	61.6	17.4
56	57	Uniroyal Chemical	908	6.1	100.0	Specialty chemicals	110	0.1	100.0	12.1	1,225	100.0	8.9
57	54	CF Industries	906	0.8	100.0	Agrochemicals	–21	def	def	def	951	100.0	–6.7
58	48	IMC Fertilizer[f]	897	–15.2	100.0	Agrochemicals	19	–90.1	100.0	2.1	2,056	100.0	0.9
59	54	Farmland Industries[h]	893	–0.6	18.9	Agricultural supplies	49	–55.3	63.6	5.5	325	18.9	15.1
60	—	Wellman	842	1.7	100.0	Basic chemicals	76	–31.3	100.0	9.1	1,015	100.0	7.5
61	32	BF Goodrich	830	–53.3	45.6	Basic chemicals	53	92.0	62.6	6.4	687	29.1	7.7
62	62	CBI Industries	826	10.7	49.4	Construction	113	4.8	95.7	13.6	na	na	na
63	69	Arcadian Partners	799	34.8	100.0	Agrochemicals	69	–10.0	100.0	8.6	1,015	100.0	6.8
64	65	Fina	793	12.3	23.2	Petroleum	60	–39.4	117.3	7.6	402	16.0	15.0
65	59	Aristech	788	–1.4	100.0	Basic chemicals	na	na	na	na	na	na	na
66	61	Georgia Gulf	769	–1.4	100.0	Basic chemicals	111	–14.2	100.0	14.4	405	100.0	27.3
67	66	Vista Chemicals[i]	701	3.9	100.0	Basic chemicals	na	na	na	na	na	na	na
68	56	NL Industries	697	–22.0	86.6	Basic chemicals	36	–55.9	57.9	5.2	1,008	83.6	3.6
69	64	Betz Laboratories	685	–3.1	100.0	Specialty chemicals	101	–22.8	100.0	14.8	521	100.0	19.4
70	60	Freeport-McMoRan	619	–22.5	38.5	Agrochemicals	–56	def	def	def	1,194	32.2	–4.7
71	71	Sigma-Aldrich	613	10.8	82.9	Specialty chemicals	149	8.5	89.7	24.2	658	87.4	22.6
72	67	Loctite	613	0.8	100.0	Specialty chemicals	na	na	na	na	na	na	na
73	71	Kerr-McGee	556	8.0	16.9	Petroleum	70	–11.4	35.2	12.6	733	20.7	9.5
74	70	Intl. Specialty Products	548	–3.9	100.0	Specialty chemicals	65	–39.6	100.0	11.9	na	na	na
75	75	GenCorp	519	7.7	27.2	Rubber products	47	4.4	38.8	9.1	na	na	na
76	80	Sterling Chemical	519	20.5	100.0	Basic chemicals	15	–12.4	100.0	3.0	540	100.0	2.9
77	73	Union Camp	519	3.7	16.6	Diversified	49	56.9	23.1	9.4	385	8.2	12.7
78	68	Merck	510	–14.2	4.9	Drugs	na	na	na	na	na	na	na
79	73	Hüls America	500	0	100.0	Specialty chemicals	na	na	na	na	na	na	na
80	86	Degussa	481	30.8	34.0	Specialty chemicals	na	na	na	na	na	na	na
81	76	Aluminum Co. of America	479	0.7	5.3	Nonferrous metals	na	na	na	na	na	na	na
82	63	Unocal	460	–37.2	5.5	Petroleum	65	75.7	10.6	14.1	387	4.2	16.8
83	77	Ferro	449	–4.2	42.1	Specialty materials	24	20.2	24.9	5.3	238	37.2	10.0
84	79	Stepan	439	0.7	100.0	Specialty chemicals	20	–35.7	100.0	4.5	300	100.0	6.5
85	82	Borden Chemicals	433	7.8	100.0	Basic chemicals	17	–63.9	100.0	3.8	444	100.0	3.7
86	—	Rexene	429	3.5	100.0	Basic chemicals	15	34.2	100.0	3.4	430	100.0	3.4
87	85	Lonza	420	10.5	100.0	Specialty chemicals	na	na	na	na	na	na	na
88	83	Crompton & Knowles	407	3.1	73.0	Specialty chemicals	68	7.3	72.4	16.7	282	77.6	24.2
89	79	Mallinckrodt	395	–10.3	22.0	Specialty chemicals	na	na	na	na	na	na	na
90	81	Sun Co.	389	–5.7	4.2	Petroleum	na	na	na	na	na	na	na
91	84	Vulcan Materials	377	–3.8	33.2	Nonmetallic minerals	17	–66.1	12.9	4.6	na	na	na
92	88	Petrolite[i]	333	10.3	94.5	Specialty chemicals	30	21.7	94.1	8.9	259	86.0	11.5
93	92	Mississippi Chemical	289	20.6	74.8	Farm cooperative	23	–27.7	473.5	7.8	287	89.4	7.9
94	87	First Mississippi[f]	285	–9.3	66.3	Agrochemicals	38	–4.6	155.8	13.2	168	50.7	22.5
95	89	Calgon Carbon	269	–9.7	100.0	Basic chemicals	33	–29.2	100.0	12.3	337	100.0	9.8
96	91	Georgia-Pacific	267	11.3	2.2	Wood products	na	na	na	na	na	na	na
97	90	Agricultural Minerals	260	6.7	100.0	Agrochemicals	53	–5.3	100.0	20.4	286	100.0	18.5
98	—	Terra Industries	229	82.4	18.5	Agrochemicals	29	93.9	58.5	12.5	na	na	na
99	94	Nova	222	–1.4	100.0	Basic chemicals	na	na	na	na	na	na	na
100	96	Cambrex Corp.	197	9.9	100.0	Specialty chemicals	17	20.4	100.0	8.4	167	100.0	10.0

a Operating profit is sales less administrative expenses and cost of sales. **b** Chemical operating profit as a percentage of sales. **c** Chemical operating profit as a percentage of identifiable chemical assets. **d** Chemical sales include significant amounts of nonchemical products. **e** Fiscal year ended Sept. 30. **f** Fiscal year ended June 30. **g** Fiscal year ended Nov. 30. **h** Fiscal year ended Aug. 31. **i** Fiscal year ended Oct. 31. **na** = not available. **def** = deficit.

FINANCIAL ANALYSIS: Most ratios at chemical companies continued to fall

		Profit margin[a]	Return on investment[b]	Debt as % of debt plus equity	% total sales abroad[c]	% total assets abroad[d]	Sales per employee[e]	Dividends as % of net income	CAPITAL SPENDING[f] As % of sales	CAPITAL SPENDING[f] As % of net plant	R&D as % of sales	Sales as % of assets	Net plant as % of gross plant
Air Products[g]	1993	6.0%	2.8%	32.6%	25.2%	31.0%	$236	50.7%	14.7%	18.1%	2.8%	69.9%	45.5%
	1992	8.6	4.1	31.3	27.6	33.3	222	33.7	13.3	15.6	2.6	71.6	47.5
American Cyanamid	1993	8.1	5.6	20.1	39.8	27.3	161	44.5	7.1	17.3	13.9	70.6	57.0
	1992	7.5	6.1	13.0	38.8	24.4	161	37.0	7.8	19.3	10.7	97.3	53.0
Arco Chemical	1993	6.7	5.1	36.0	34.5	36.4	na	112.1	5.7	8.3	2.3	91.1	66.7
	1992	8.5	6.1	39.0	42.9	36.6	728	94.9	9.9	13.2	2.2	83.0	70.5
Betz Laboratories	1993	10.7	9.6	24.6	20.7	23.3	166	64.6	9.2	21.0	4.2	131.4	54.2
	1992	11.6	11.5	24.8	21.2	22.2	170	54.8	10.5	25.8	4.0	138.5	56.6
Cabot[g]	1993	3.5	3.2	50.9	41.5	42.7	299	40.2	4.0	10.1	2.8	108.4	51.7
	1992	4.0	3.4	49.3	46.1	46.7	288	36.5	5.0	11.1	2.4	100.2	55.2
Calgon Carbon	1993	7.1	4.6	2.6	38.4	31.9	204	34.3	5.6	7.7	2.4	79.9	69.4
	1992	9.6	7.2	2.8	40.2	33.0	202	22.8	8.1	11.8	2.1	89.2	74.2
Crompton & Knowles	1993	9.3	13.2	5.5	18.5	22.8	240	37.5	2.6	14.3	2.0	153.7	57.7
	1992	8.4	11.7	10.2	20.1	23.3	237	34.2	2.5	13.0	2.0	147.6	60.6
Dow Chemical	1993	3.6	2.2	42.4	48.6	41.6	326	111.6	7.8	16.5	7.0	70.8	39.7
	1992	2.9	1.9	43.4	49.7	42.6	309	128.9	8.5	18.3	6.8	74.8	41.0
Eastman Chemical	1993	6.8	3.6	62.9	21.7	10.7	216	6.7	9.4	12.0	4.5	89.9	47.9
	1992	7.9	4.2	0	23.5	8.2	206	23.3	12.3	15.3	4.3	90.7	49.3
Ethyl	1993	5.8	4.3	47.7	32.5	31.3	352	63.2	10.6	20.5	3.9	96.5	52.3
	1992	9.1	11.1	24.8	17.2	5.0	472	26.4	5.3	19.0	2.5	32.3	50.6
First Mississippi[h]	1993	0.6	0.5	41.4	13.7	na	na	223.4	2.6	5.5	1.2	112.1	55.8
	1992	0.8	0.7	43.4	15.5	na	na	140.1	6.4	12.1	0.8	112.1	56.6
Freeport-McMoRan	1993	def	def	99.9	na	na	na	def	35.3	20.5	na	43.4	65.9
	1992	11.3	4.4	80.5	na	na	na	95.7	38.8	28.2	na	46.7	68.9
H. B. Fuller[i]	1993	2.8	3.8	19.5	46.3	77.9	163	27.8	4.3	18.0	2.2	172.8	55.4
	1992	3.8	5.1	17.3	47.4	71.2	161	18.0	3.7	15.4	2.2	166.4	56.5
Georgia Gulf	1993	5.5	7.5	143.4	na	na	684	0	3.8	13.2	na	189.7	57.3
	1992	5.9	8.5	164.9	na	na	691	0	1.8	6.7	na	185.8	59.9
BF Goodrich	1993	0.8	0.7	35.2	11.0	7.0	136	422.2	8.0	17.5	3.7	77.0	61.4
	1992	0.4	0.3	32.7	11.2	7.8	189	638.6	7.9	16.5	3.3	103.0	55.5
W. R. Grace	1993	3.0	2.8	43.6	35.2[j]	20.1[j]	130	95.5	7.0	21.3	3.1	72.2	52.3
	1992	4.0	4.1	46.7	37.0[j]	11.3[j]	125	57.4	7.2	23.3	2.7	98.6	51.9
Great Lakes Chemical	1993	14.9	16.2	4.6	51.7	41.7	na	9.2	4.3	16.9	3.0	96.2	56.3
	1992	15.6	15.4	4.2	49.0	45.0	na	9.5	4.6	16.1	3.1	86.4	58.2
Hercules	1993	7.5	4.6	18.8	28.1	19.9	197	45.6	5.4	11.4	2.7	87.7	40.0
	1992	5.9	3.8	19.8	29.4	19.2	186	59.9	5.2	11.1	2.5	88.8	42.1
IMC Fertilizer[h]	1993	def	def	67.5	15.9	14.3	na	def	11.8	8.0	na	43.6	54.8
	1992	8.6	3.5	50.6	14.2	16.5	na	26.2	16.8	14.0	na	57.6	54.6
International Flavors	1993	17.0	13.6	0	67.5	50.1	272	56.6	6.9	25.4	6.3	97.0	53.0
	1992	15.7	11.6	0	68.9	43.3	266	59.1	4.4	17.3	6.3	88.9	51.7

		Profit margin[a]	Return on investment[b]	Debt as % of debt plus equity	% total sales abroad[c]	% total assets abroad[d]	Sales per employee[e]	Dividends as % of net income	CAPITAL SPENDING[f] As % of sales	CAPITAL SPENDING[f] As % of net plant	R&D as % of sales	Sales as % of assets	Net plant as % of gross plant
Lawter International	1993	14.5%	10.9%	3.7%	45.6%	26.7%	$321	71.7%	7.5%	29.3%	2.6%	82.2%	50.3%
	1992	16.1	13.0	3.7	45.1	27.5	366	65.0	4.5	20.6	2.4	89.4	46.6
Loctite	1993	11.1	11.2	0.8	54.1	56.7	155	41.0	7.6	28.1	4.4	101.6	58.6
	1992	11.9	12.9	3.6	60.4	64.2	165	36.2	6.6	28.9	4.3	109.1	57.1
Lubrizol	1993	7.5	6.8	7.0	55.8	42.7	329	50.8	8.4	29.2	11.3	128.3	40.2
	1992	8.1	8.0	2.8	53.0	39.6	335	44.8	6.2	25.5	5.9	137.0	39.2
Monsanto	1993	5.8	4.2	34.5	34.7	31.1	263	59.8	5.5	15.6	7.9	91.5	38.0
	1992	4.8	3.2	32.1	36.1	32.7	230	72.0	7.5	19.5	8.4	85.4	39.5
Morton International[h]	1993	7.0	6.6	15.4	24.2	20.6	194	29.0	8.7	22.0	3.0	103.2	58.2
	1992	7.1	6.5	15.4	27.1	23.6	191	32.2	9.8	24.0	3.0	96.8	58.9
Nalco Chemical	1993	11.0	10.1	31.4	35.9	32.9	204	47.1	8.5	21.1	3.6	114.6	49.4
	1992	10.5	9.3	41.8	40.7	31.9	205	47.5	9.5	24.6	3.5	101.8	51.1
Olin	1993	1.7	1.2	60.9	7.5	7.1	195	147.5	5.4	14.9	1.7	125.5	35.3
	1992	2.3	1.7	39.2	6.5	9.0	176	105.5	7.3	18.5	1.6	117.0	37.5
Petrolite[k]	1993	5.8	4.9	19.7	34.2	24.5	176	61.5	5.4	15.2	3.9	116.8	43.0
	1992	5.2	4.3	0	32.8	29.3	159	77.2	5.8	17.1	3.8	131.9	40.4
PPG Industries	1993	7.1	5.1	23.1	31.8	30.5	183	54.0	4.5	9.2	3.5	101.8	46.1
	1992	5.7	4.1	23.7	35.8	32.4	180	60.5	4.9	9.5	3.5	102.7	48.3
Praxair	1993	5.9	2.6	60.3	51.3	56.0	145	22.4	9.8	10.6	2.4	74.9	48.0
	1992	3.2	1.6	55.2	57.3	56.3	140	19.0	12.8	14.4	2.4	77.9	50.4
Quaker Chemical	1993	3.1	3.2	15.0	43.6	36.5	194	90.6	4.6	15.8	5.7	114.0	52.8
	1992	5.7	6.6	15.5	44.1	36.8	219	42.1	3.4	13.8	5.2	127.5	53.4
Rohm and Haas	1993	5.5	3.7	32.4	41.8	35.4	252	53.6	11.7	20.4	6.3	92.8	50.6
	1992	6.9	4.5	32.9	43.4	32.6	221	41.7	9.2	16.0	6.5	88.9	51.0
Sigma-Aldrich	1993	14.5	12.2	2.8	28.3	29.9	145	13.9	10.2	29.2	na	98.1	60.5
	1992	14.6	12.8	3.5	30.1	28.5	152	13.6	4.7	16.4	na	106.3	57.2
Stepan	1993	2.5	2.2	46.2	16.0	14.7	337	47.4	5.8	15.1	4.0	146.0	44.7
	1992	2.4	2.2	47.6	16.1	13.9	331	40.0	7.9	20.5	2.6	146.7	47.4
Sterling Chemicals[g]	1993	def	def	78.5	23.0	39.1	421	def	2.3	3.9	na	96.1	70.3
	1992	1.1	0.7	77.0	3.1	39.4	351	297.3	3.7	4.6	na	71.7	77.2
Union Carbide	1993	3.6	2.3	39.5	25.8	18.5	356	75.2	8.5	12.3	3.0	99.0	57.0
	1992	2.4	1.6	47.3	27.6	21.2	323	109.2	7.4	11.3	3.2	98.6	56.7
Witco	1993	3.7	3.8	41.0	29.1	35.9	261	55.9	4.8	14.9	2.3	116.5	52.8
	1992	3.9	3.3	22.0	22.2	37.7	199	60.2	4.2	10.1	1.7	95.4	56.0
AVERAGE 1993		5.3%	3.6%	38.6%	35.9%	31.7%	$226	64.7%	7.9%	15.3%	5.2%	84.7%	48.1%
AVERAGE 1992		5.6%	4.0%	33.5%	36.7%	29.6%	$221	58.5%	8.4%	16.7%	4.9%	83.4%	49.1%

Note: Net income is from continuing operations, excluding significant nonrecurring and extraordinary items. **a** Net income as a percentage of sales. **b** Net income as a percentage of current assets plus gross plant. **c** Consolidated sales only. **d** Foreign identifiable assets as a percentage of total assets. **e** Thousands of dollars. **f** Actual spending on new facilities and purchase of land and new equipment in consolidated companies. **g** Fiscal year ended Sept. 30. **h** Fiscal year ended June 30. **i** Fiscal year ended Nov. 30. **j** Excludes Canada. **k** Fiscal year ended Oct. 31. **na** = not available. **def** = deficit.

Chemical capital spending continued to fall in 1993

Capital spending declined for the third year in a row at major chemical companies in 1993. Big-budget projects continued to feel the lingering effects of the 1991–92 recession as capital spending at 24 major chemical makers surveyed by C&EN dropped an average of 10% last year to a collective $6.9 billion. Capital spending as a percentage of sales also declined in 1993 to 8.0%. The last time spending as a percentage of sales was so low was in 1987.

The drop in capital spending follows an average 9% decline in 1992 and a 13% cutback in 1991. Still, none of these drops are as large as the 25% downturn a decade ago in 1983 when industry overcapacity and recession forced capital outlays to hit their 10-year low of $4.7 billion.

The chemical industry had more than adequate capacity in place as the U.S. came out of recession in late 1992 and early 1993. Because of hefty investments between 1988 and 1990, coupled with falling earnings for the past four years for the industry as a whole, most major chemical companies opted to cut back further on building new plants in 1993.

Between 1988 and 1990, the major chemical companies invested heavily in their operations. As both profits and demand for products rose during those years, capital spending was increased at double-digit rates. Capital expenditures for the group reached a 10-year peak of $9.7 billion in 1990.

The Department of Commerce's survey of the chemical industry, based on a much larger number of companies than those surveyed by C&EN, shows capital spending also declined in 1993. That survey registered a 6% spending decline last year to $21.8 billion.

The reason for the discrepancy in the two surveys is that the 24 major chemical companies C&EN monitors are all identified by the Commerce Department as producers of industrial chemicals and synthetic materials. Such producers make up less than half of the companies in the Department of Commerce's survey of the chemical industry, which also includes manufacturers of pharmaceuticals, soaps, toiletries, and paints. For 1994, the government survey projects an 8% increase in capital outlays for the broadly defined chemical industry.

All manufacturing companies increased capital spending 3% in 1993 to $179 billion, the Commerce Department finds. That follows two years of declining overall investment in new plants and equipment. Generally, the turnaround for manufacturing companies coupled with solid evidence of growth in many key markets for chemicals—such as housing and motor vehicles—suggests that the chemical industry, too, may soon increase its capital outlays.

A separate Commerce Department survey of capital spending abroad shows that U.S. chemical companies have slowed their capital outlays outside the U.S. as well. Spending declined 2% to $6.2 billion in 1993, following bigger drops of 3% in 1992 and 6% in 1991. The Commerce Department predicts a recovery in 1994, with chemical firms planning to spend $6.6 billion abroad, more than 6% above the 1993 level. The survey also indicates that all U.S. manufacturing firms dropped their overseas capital investment 3% in 1993 to $27.7 billion—a figure that is likely to increase a substantial 9% in 1994.

INDUSTRY CAPITAL SPENDING: Resumed growth for all manufacturing last year

$ Billions	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994[a]
All manufacturing	$138.82	$153.48	$142.69	$145.90	$165.70	$183.80	$192.61	$182.81	$174.02	$179.18	$191.60
Chemicals & allied products	15.32	16.44	16.81	16.42	19.25	18.47	20.63	21.52	23.15	21.78	23.50
Iron & steel	3.54	4.12	3.32	4.69	6.16	7.87	7.78	6.53	5.64	5.60	7.71
Nonferrous metals	2.13	1.88	1.93	2.16	2.77	2.64	2.88	2.81	2.67	2.57	2.24
Paper	7.21	8.59	8.77	9.01	11.23	15.58	16.53	11.50	10.53	10.30	10.79
Petroleum	25.53	26.71	17.92	17.12	19.93	30.08	34.79	35.59	29.59	28.54	27.95
Rubber	3.11	3.86	3.89	3.52	3.86	3.79	3.48	3.43	3.85	3.30	3.61
Stone, clay, glass	3.09	3.40	3.14	3.37	3.59	4.00	3.29	2.89	3.36	4.30	4.81

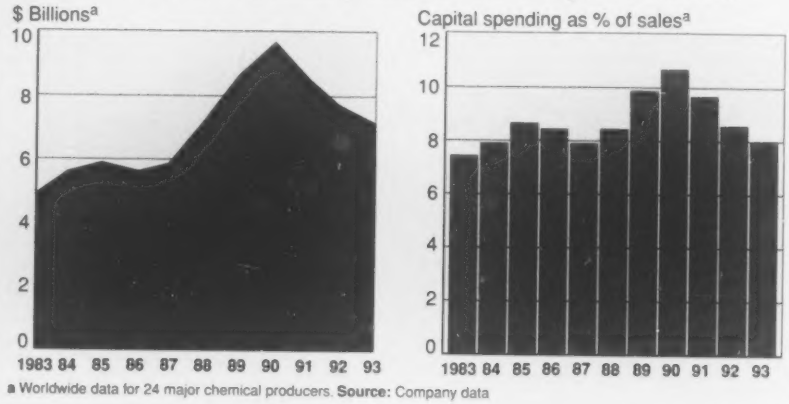
a Estimated. **Source:** Department of Commerce

U.S. chemical makers decreased capital spending abroad in 1993, but plan increases in 1994

$ Billions[a]	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994[b]
All manufacturing	$13.6	$14.9	$16.4	$17.2	$22.4	$28.6	$31.1	$28.5	$28.6	$27.7	$30.1
Chemicals & allied products	2.4	2.7	3.1	3.7	4.9	6.4	6.9	6.5	6.3	6.2	6.6
Metals, primary & fabricated	1.0	0.9	0.9	0.8	1.2	1.8	1.9	1.1	1.1	1.2	1.2
Petroleum	14.1	13.7	9.6	9.8	13.3	14.5	15.9	18.6	18.4	19.2	20.8

a By majority-owned affiliates of U.S. companies. b Planned. **Source:** Department of Commerce

Chemical capital spending down for third year in a row



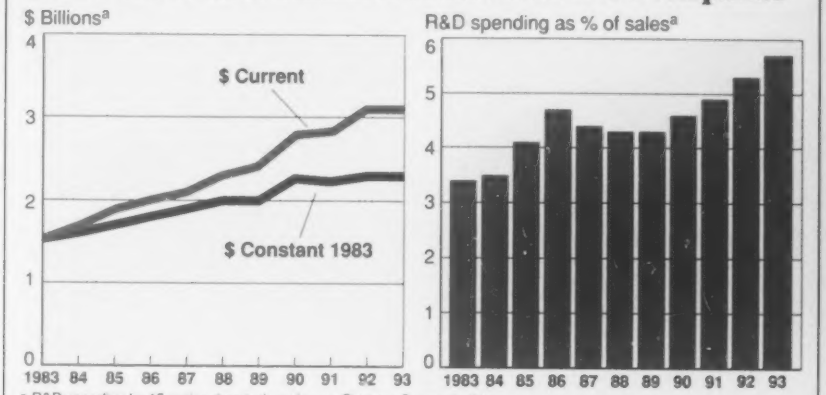
a Worldwide data for 24 major chemical producers. **Source:** Company data

CHEMICAL CAPITAL SPENDING: At lowest level in six years for major chemical companies

$ Millions	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Air Products	$246	$263	$392	$367	$323	$387	$414	$468	$506	$428	$491
Cabot[a]	80	505	184	80	83	170	192	174	198	78	65
Crompton & Knowles	2	3	3	4	4	7	13	16	11	13	14
Dow Chemical	630	781	806	890	995	1,267	1,764	2,119	1,908	1,608	1,414
DuPont[b]	888	989	1,176	1,229	1,357	1,735	2,106	2,608	2,045	2,058	1,667
Ethyl	85	103	90	134	139	151	119	152	166	157	205
H. B. Fuller	15	13	15	13	30	40	41	31	30	34	42
BF Goodrich	115	153	202	144	143	181	240	243	219	200	146
W. R. Grace	353	380	348	199	243	418	485	514	447	398	310
Great Lakes Chemical	20	29	21	18	35	47	40	49	71	69	69
Hercules	168	218	234	257	205	251	293	273	214	150	149
Loctite	9	10	9	11	17	15	24	29	34	40	46
Lubrizol	25	30	40	41	42	55	65	77	82	96	128
Monsanto	560	614	645	520	505	590	607	750	591	586	437
Nalco Chemical	41	53	60	64	57	62	86	115	137	131	118
Olin	123	165	154	128	115	147	142	187	177	173	132
PPG Industries	450	315	452	498	499	410	671	567	335	282	258
Petrolite	9	11	24	25	19	20	19	18	22	18	19
Praxair[c]	—	—	—	—	—	—	—	—	—	333	240
Quaker Chemical	2	4	6	5	4	5	8	13	8	7	9
Rohm and Haas	72	124	159	179	222	338	385	412	265	283	382
Stepan	10	12	19	14	26	20	34	38	34	34	25
Union Carbide	761	670	649	524	502	671	785	744	817	359	395
Witco	55	85	76	60	69	72	70	91	74	73	104
TOTAL	**$4,719**	**$5,530**	**$5,764**	**$5,404**	**$5,634**	**$7,059**	**$8,603**	**$9,688**	**$8,391**	**$7,608**	**$6,865**
ANNUAL CHANGE	**–25%**	**17%**	**4%**	**–6%**	**4%**	**25%**	**22%**	**15%**	**–13%**	**–9%**	**–10%**

Note: Figures are for worldwide spending on construction, equipment, and land in consolidated businesses. Where possible, acquisition costs and investments in nonconsolidated businesses are excluded. Prior years are not restated to reflect company revisions. a Includes acquisitions and investments. b Excludes Conoco. c Spun off from Union Carbide in 1992.
Source: Company data

R&D share of sales continues to rise at chemical companies



a R&D spending by 15 major chemical producers. **Source:** Company data

R&D SPENDING: Chemical firms hold on to 1992 gains as other companies cut back

$ Millions	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
CHEMICAL COMPANIES											
Air Products[a]	$40	$44	$51	$61	$57	$72	$71	$72	$80	$85	$92
Dow Chemical	492	507	547	605	670	772	873	1,136	1,159	1,289	1,256
Ethyl[b]	39	40	47	47	50	59	61	65	69	73	76
W. R. Grace	73	81	92	94	107	119	125	148	150	151	135
Hercules	74	72	76	71	74	74	79	92	86	70	76
International Flavors	32	32	34	39	45	50	52	57	62	71	75
Lubrizol	37	33	44	51	62	65	70	74	80	90	172
Monsanto	290	370	470	596	615	648	598	612	627	651	626
Morton International[c,d,e]	23	30	25	29	31	35	38	48	59	61	69
Nalco Chemical	30	32	32	33	35	37	41	45	47	48	50
Olin	49	52	53	56	62	58	66	66	41	39	41
Petrolite	13	12	12	12	12	12	12	12	11	12	14
Praxair[f]	—	—	—	—	—	—	—	—	—	62	58
Rohm and Haas	100	109	124	133	142	156	175	178	183	199	205
Union Carbide	245	265	275	148	159	159	181	191	190	155	139
TOTAL	**$1,537**	**$1,679**	**$1,882**	**$1,975**	**$2,121**	**$2,316**	**$2,442**	**$2,796**	**$2,844**	**$3,056**	**$3,084**
ANNUAL CHANGE	**7%**	**9%**	**12%**	**5%**	**7%**	**9%**	**5%**	**14%**	**2%**	**7%**	**1%**
PHARMACEUTICAL & DIVERSIFIED COMPANIES											
AlliedSignal[c]	$280	$295	$343	$459	$400	$415	$381	$426	$381	$320	$313
American Cyanamid	208	232	251	278	314	365	406	460	492	566	596
AT&T Bell Labs	2,000	1,900	1,900	2,100	2,250	2,660	2,800	2,900	3,100	3,200	3,069
Bristol-Myers Squibb	301	344	412	474	563	688	789	881	993	1,083	1,128
DuPont	966	1,097	1,144	1,156	1,223	1,319	1,387	1,428	1,298	1,277	1,132
Eli Lilly	294	341	370	427	466	512	605	703	767	925	955
FMC	102	121	149	146	132	144	150	158	135	145	149
IBM	2,500	3,148	3,457	3,975	3,998	4,419	5,201	4,419	5,001	5,003	4,431
Merck & Co.	356	393	426	480	566	669	751	854	998	1,112	1,173
3M	396	454	520	586	650	721	784	865	914	1,007	1,030
Pfizer	230	255	287	336	401	473	531	640	757	863	974
PPG Industries	127	150	176	204	227	232	233	218	220	203	201
Procter & Gamble[d]	327	369	400	479	549	615	628	693	786	861	956
Schering-Plough	145	164	175	212	251	298	327	380	426	522	578
Upjohn	218	247	284	314	356	380	407	427	491	549	642
TOTAL	$8,450	$9,510	$10,294	$11,626	$12,346	$13,910	$15,380	$15,452	$16,759	$17,636	$17,327
ANNUAL CHANGE	12%	13%	8%	13%	6%	13%	11%	1%	9%	5%	–2%

Note: Prior years are not restated to reflect company revisions. **a** For fiscal year ending Sept. 30. **b** Beginning in 1989, excludes Tredegar Industries, spun off in 1989. **c** Includes all company-financed R&D but excludes contract R&D. **d** Fiscal year ends June 30. **e** Data for Morton Thiokol prior to 1985. **f** Spun off from Union Carbide in 1992. **Source:** Company data

SHIPMENTS: Except for drugs, chemical categories grew less than all manufacturing

$ Billions	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	% annual change 1992–93	% annual change 1983–93
All manufacturing industries	$2,070.7	$2,288.2	$2,334.5	$2,335.9	$2,475.9	$2,682.5	$2,792.7	$2,873.6	$2,821.9	$2,934.1	$3,100.7	6%	4%
Chemicals & allied products	189.6	206.0	204.8	205.7	229.5	259.7	278.1	288.2	289.0	301.5	312.5	4	5
Industrial chemicals	109.1	119.4	114.7	112.2	126.2	145.5	156.2	157.3	152.3	156.4	160.9[a]	3	4
Drugs, soaps & toiletries	54.6	57.7	61.3	66.4	74.0	81.8	88.0	95.2	101.9	110.4	118.0[a]	7	8
Petroleum & coal products	187.8	184.5	176.6	122.6	130.4	131.4	143.7	172.7	160.4	154.6	147.0	–5	–2
Rubber & plastic products	62.9	72.9	75.6	78.4	86.6	94.2	98.4	101.4	103.6	103.3	104.5	1	5
Paper & allied products	84.8	95.5	94.7	99.9	109.0	122.6	131.4	131.4	124.4	131.3	129.2	–2	4

a Preliminary. **Source:** Department of Commerce

PRICES: Little change for either chemicals or all commodities

Producer price indexes, 1982 = 100	Annual average 1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	% annual change 1992–93	% annual change 1983–93
All commodities	101.3	103.7	103.1	100.2	102.8	106.9	112.2	116.3	116.5	117.2	118.9	1%	2%
Industrial commodities	101.1	103.3	103.7	99.9	102.6	106.3	111.6	115.8	116.5	117.4	119.0	1	6
Finished goods	101.6	103.7	104.7	103.2	105.4	108.0	113.6	119.2	121.7	123.2	124.7	1	2
Chemicals & allied products	100.2	102.9	103.7	102.5	106.4	116.3	123.0	123.6	125.6	125.9	128.2	2	3
Industrial chemicals	97.3	96.8	96.0	91.5	95.5	106.8	114.8	113.2	111.8	109.3	110.4	1	1
Prepared paint	100.7	103.7	105.3	107.0	108.1	112.2	119.5	124.8	129.9	131.6	133.2	1	3
Paint materials	100.3	108.2	109.5	104.4	107.3	115.7	129.1	136.3	135.8	131.1	131.5	0	3
Drugs & pharmaceuticals	107.7	114.2	122.2	129.9	139.1	148.4	160.0	170.8	182.6	192.2	200.9	5	6
Fats & oils, inedible	106.2	139.1	110.6	80.5	92.7	10.9	95.5	88.1	86.8	93.0	95.6	3	–1
Agricultural chemicals & chemical products	96.0	97.4	96.2	94.2	96.4	104.5	108.7	107.4	111.7	110.3	109.9	0	1
Plastic resins & materials	102.4	108.9	107.5	104.4	110.3	132.4	133.4	124.1	120.0	116.4	117.1	–1	1
Other chemicals & allied products	101.3	102.7	105.2	105.8	107.0	111.9	117.3	118.9	121.5	123.3	125.5	2	1
Rubber & plastic products	100.8	102.2	101.9	101.9	103.0	109.3	112.6	113.6	115.1	115.1	116.0	1	1

Source: Department of Labor

Chemical stock prices set new highs in 1993 and early 1994

a C&EN stock price index of Air Products, Dow Chemical, W. R. Grace, Hercules, Monsanto, Rohm and Haas, and Union Carbide, weighted according to number of shares outstanding for each company.

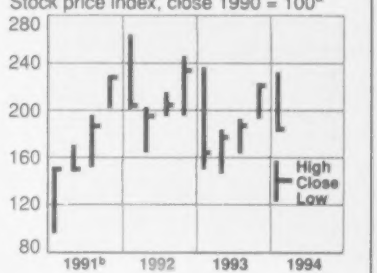
Major biotechnology firms post good year

Biotechnology companies that have major biopharmaceutical products on the market had substantially increased sales in 1993. Combined sales of six industry leaders rose 26% to $2.4 billion. However, 54% of the total sales for the six companies combined were from two major products sold by Amgen.

Four of the six companies reported profits in 1993. A fifth company, Genzyme, posted a relatively small $6 million loss, the net result of R&D acquisition and restructuring costs. Similarly, Immunex's $430 million net loss resulted largely from a $346 million charge for acquiring R&D at the time of its merger with Lederle Laboratories' oncology business.

Biotechnology is such a young industry, however, that many key companies have yet to bring a major product to market or show a profit. C&EN's biotechnology stock index, which includes six firms that do not have major products and five that do, offers some measure of how investors feel about the industry as a whole. This index fluctuated from a high of 264 to a low of 163 in 1992. It remained volatile in 1993 as well. Uncertainties brought about by the specter of health care reform and setbacks for a few major products being developed scared investors away from biotechnology stocks. After dropping 89 points from the start of 1993 to reach a two-year low early in the second quarter, the index recovered most of its losses, ending 1993 just 14 points below where it ended 1992, only to fall again in early 1994.

Biotechnology stock prices remain volatile



a C&EN biopharmaceutical stock price index of Amgen, Applied Bioscience, Biogen, Centocor, Chiron, Cytogen, Genentech, Genetics Institute, Immunex, Repligen, and Xoma. b Based on Friday close each week, all other years based on daily close.

COMPANY RESULTS: Sales up strongly for major biotechnology companies

	Net sales	Net income	R&D spending	R&D as % of sales	Total assets	Net plant and equipment	Stockholders' equity	NET INCOME: % of sales	NET INCOME: % of stockholders' equity	NET INCOME: $ per share	Stock price range, $ per share	Price-earnings ratio
	(Money figures in millions of dollars unless otherwise indicated)											
Amgen												
1993	$1,306.3	$374.6[a]	$255.3	19.5%	$1,765.5	$586.9	$1,172.0	28.7%	32.0%	$2.67	$70¾–31½	19.1
1992	1,050.7	357.6[b]	182.3	17.4	1,374.3	426.0	933.7	34.0	38.3	2.43	77¾–50	26.3
1991	645.3	97.9[c]	120.9	18.7	865.5	245.7	531.1	15.2	18.4	0.67	75¾–18⅞	70.6
1990[d]	281.4	3.9[e]	72.4	25.7	459.5	150.0	309.1	1.4	1.3	0.30	21 3/16–7½	478.1
Biogen												
1993	$136.4[f]	$32.4	$79.3	58.1%	$357.0	$38.5	$325.2	23.8%	10.0%	$0.93	$47¾–24¼	38.7
1992	121.7[f]	38.3	60.4	49.6	311.2	32.3	284.9	31.5	13.4	1.12	49¾–18¼	30.4
1991	56.5[f]	7.2	44.3	78.4	253.1	28.7	239.0	12.7	3.0	0.15	49–24¼	244.2
1990	44.9[f]	7.7	36.2	80.6	158.5	23.6	145.7	17.1	5.3	0.07	29⅜–14⅜	312.5
Chiron												
1993	$147.9	$18.4	$140.0	94.7%	$968.6	$204.0	$522.3	12.4%	3.5%	$0.55	$85½–41⅛	115.1
1992[g]	111.6	(95.9)[h,i]	142.9	128.0	712.4	89.6	492.9	—	—	(3.18)[h,i]	73¾–34¾	—
1991	28.2	(425.2)[h,j]	79.4	281.6	895.3	78.0	524.4	—	—	(22.12)[h,j]	77½–37¼	—
1990	14.7	4.0[k]	50.2	341.5	265.4	24.5	120.3	27.2	3.3	0.24[k]	44¾–23½	142.2
Genentech												
1993	$457.4	$58.9	$299.4	65.5%	$1,468.8	$456.7	$1,116.8	12.9%	5.3%	$0.50	$50½–31¼	81.8
1992	391.0	20.8	278.6	71.3	1,305.1	432.5	1,007.3	5.3	2.1	0.18	39½–25⅞	181.6
1991	383.3	44.3	221.3	57.7	1,231.0	342.5	949.7	11.6	4.7	0.39	36¼–20¾	73.1
1990	367.2	(98.0)[h,l]	173.1	47.1	1,157.7	300.2	893.2	—	—	(1.05)[h]	30⅞–20⅛	—
Genzyme												
1993	$233.9	$(6.1)[h,m]	$48.3	20.6%	$542.1	$196.2	$334.1	—	—	$(0.25)[h]	$46¼–25¼	—
1992	180.0	39.5[n]	39.7	22.1	480.7	87.9	322.9	21.9%	12.2%	1.83[n]	66½–32½	27.0
1991	81.1	11.2[o]	27.2	29.1	390.5	32.1	259.9	13.8	4.3	0.50[o]	58¾–23⅜	82.1
1990	34.6	(27.2)[h,p]	18.6	53.8	118.1	29.5	96.2	—	—	(1.70)[h]	28⅝–12½	—
Immunex												
1993	$119.1[q]	$(430.3)[h,q,r]	$72.5[q]	60.0%[q]	$204.1[s]	$100.5[s]	$137.9[s]	—	—	$(9.58)[h,r,s]	$34¾–13¾[s]	—
1992	51.9	(77.6)[h,t]	37.1	71.5	235.8	97.0	134.0	—	—	(5.21)[h]	68–22½	—
1991	34.2	0.8	29.4	86.0	254.0	73.1	212.2	2.3%	0.4%	0.05	61½–33¼	947.5
1990	4.9	(9.9)[h]	23.2	473.5	121.1	36.3	106.5	—	—	(1.10)[h]	40¼–15½	—

a Includes $13.9 million legal award. b Includes $77 million pretax legal award. c Includes $129 million pretax legal assessment. d Figures reflect change in fiscal-year end from March 31 to Dec. 31 that occurred in 1991. e Includes $54.7 million royalty buyout. f Includes royalty income from licensees' sales of several major products. g Includes results of Cetus following Dec. 12, 1991, acquisition, and of Intraoptics following Jan. 8, 1992, acquisition. h Net loss. i Includes $40 million write-off of technologies but excludes $6.7 million loss from retirement of debt ($0.22 per share). j Includes $426 million charge for acquiring Cetus but excludes $100,000 gain for operating loss carryforward ($0.01 per share). k Excludes $2.8 million gain for operating loss carryforward ($0.16 per share). l Includes $167.7 million charge related to merger with Hoffmann-La Roche. m Includes $49 million purchase of R&D and $26.5 million goodwill and restructuring costs. n Excludes $51 million purchase of R&D, $17 million purchase of option rights, and $1.8 million charge for Vivigen acquisition ($3.24 per share). o Excludes $8.4 million gain for operating loss carryforward ($0.37 per share). p Includes $20.8 million purchase of R&D and $9.1 million repurchase option. q Merged June 2, 1993, with Lederle Laboratories oncology business; combined figures for predecessor and successor company. r Includes $346.4 million for acquisition of in-process R&D, $14.8 million for merger costs, and $25.6 million for modified stock option plan. s Merged June 2, 1993, with Lederle Laboratories oncology business; figures for successor company only. t Includes $58.7 million purchase of R&D.

Explanation of column headings in tables of company results

Year. Data are for calendar year unless otherwise indicated. Data for earlier years are not restated to reflect subsequent acquisitions or divestitures.

Net sales. Gross sales, less discounts, allowances, and returns; generally excludes excise taxes and other operating income or revenues.

Net income. Net sales and other income, less operating costs, nonoperating charges, depreciation, depletion, interest expense, deferred charges, minority interest in income, and taxes. Nonrecurring or extraordinary credits and charges have been excluded in most cases, and are indicated by a footnote.

Total assets. Sum at year's end of current assets, investments, prepaid expenses, net plant and equipment, and other tangible assets. Excludes insofar as possible intangible assets including goodwill, value of patents, and the like.

Net plant and equipment. Value at year's end of fixed assets, less accumulated depreciation, amortization, and depletion.

Capital expenditures. Total spending during the year for new fixed assets, such as plant, equipment, and land, and for replacement and modernization of facilities.

Stockholders' equity. Equity at year's end of preferred and common stockholders, including value of capital stock, capital and earned surplus, and surplus reserves, as well as contingency and miscellaneous reserves for which no definite purpose is stated. Intangible assets are deducted insofar as possible.

Net income (breakdown). Percent of sales: net income divided by net sales. Percent of stockholders' equity: net income divided by stockholders' equity. Dollars per share: net income, less preferred dividends, divided by the number of shares of common stock outstanding. All figures are adjusted for stock splits, but no adjustment has been made for earlier years as a result of stock dividends or for dilution that might result from the conversion of preferred stock or debt to common stock or the exercise of stock options outstanding.

Dividends per share. Cash dividends paid (or declared) on each share of common stock; excludes the value of stock dividends, which are indicated by a footnote.

Dividend yield. Dividends per share divided by the average of the high and low prices of the common stock during the year.

Stock price range. High-low market prices of common stock during the year, adjusted for stock splits but not for stock dividends.

Price-earnings ratio. Average of the high and low prices of the common stock during the year divided by net income per share.

COMPANY RESULTS: About half of chemical firms increased sales in 1993

Year	Net sales	Net income	Total assets	Net plant and equipment	Capital expenditures	Stockholders' equity	NET INCOME % of sales	NET INCOME % of stockholders' equity	NET INCOME $ per share	Dividend, $ per share	Dividend yield, % of price	Stock price range, $ per share	Price-earnings ratio
					(Money figures in millions of dollars unless otherwise indicated)								
CHEMICALS													
Air Products													
1993[a]	$3,328	$200.9[b]	$4,697	$2,705.6	$490.6	$2,037	6.0%	9.9%	$1.76[b]	$0.89	2.1%	$49⅛–37½	24.6
1992[a]	3,217	271.0	4,420	2,745.7	427.5	2,026	8.4	13.4	2.40	0.805	1.7	49½–31¾	19.4
1991[a]	2,931	248.9	4,163	2,622.6	506.4	1,777	8.5	14.0	2.22	0.75	2.6	37–21½	13.2
1990[a]	2,895	229.9	3,845	2,485.1	467.5	1,634	7.9	14.1	2.07	0.69	2.7	30½–21½	12.5
Arco Chemical													
1993	$3,192	$214.0	$3,502	$2,173.0	$181.0	$1,576	6.7%	13.6%	$2.23	$2.50	5.8%	$47¼–39¼	19.4
1992	3,098	197.0[c]	3,599	2,230.0	295.0	1,630	6.4	12.1	2.05[c]	2.50	6.0	47¼–36½	20.4
1991	2,837	188.0	3,676	2,166.0	435.0	1,696	6.6	11.1	1.96	2.50	6.4	44¼–33⅛	19.7
1990	2,830	308.0[d]	3,739	1,768.0	539.0	1,758	10.9	17.5	3.21[d]	2.50	6.8	44¼–29¾	11.5
Betz Laboratories													
1993	$685	$63.4[e]	$517	$300.7	$63.2	$295	9.3%	21.5%	$2.05[e]	$1.39	2.7%	$62⅞–40	24.3
1992	707	82.0	506	288.4	74.3	293	11.6	28.0	2.71	1.33	2.3	66¼–48¼	21.1
1991	666	75.5	471	254.6	58.4	254	11.3	29.8	2.47	1.20	2.4	62–38¾	20.4
1990	597	65.5	421	233.5	57.5	214	11.0	30.6	2.12	1.01	2.7	43¼–30¾	17.5
Borden Chemicals & Plastics													
1993	$433	($1.4)[f]	$444	$306.0	$15.0	$230	—	—	($0.04)[f]	$0.78[g]	6.1%	$17⅛–8¼[g]	—
1992	402	27.1	467	335.1	10.5	261	6.7%	10.4%	0.73[g]	1.59[g]	9.0	22⅞–12⅜[g]	24.1
1991	410	51.6	507	369.2	18.0	293	15.7	17.6	1.39[g]	1.98[g]	17.1	14¾–8⅜[g]	8.3
1990	421	45.3	544	395.8	22.1	315	10.8	14.4	1.22[g]	1.95[g]	19.0	12¾–7¾[g]	8.4
Cabot													
1993[a]	$1,614	$37.4[h]	$1,411	$646.5	$65.0	$363	2.3%	10.3%	$1.80[h]	$1.04	2.2%	$56¼–37¼	26.0
1992[a]	1,557	62.2	1,467	703.2	78.1	406	4.0	15.3	3.18	1.04	2.6	52¼–28⅛	12.6
1991[a]	1,482	39.8[i]	1,365	670.4	198.0	329	2.7	12.1	1.69[i]	1.04	3.5	35⅞–23	17.4
1990[a]	1,673	71.0	1,627	878.7	174.4	466	4.2	15.2	2.73	1.04	3.3	37½–25	11.4

a Fiscal year ends Sept. 30. b Includes charge for cost of work force reduction of $76.0 million ($0.67 per share). c Excludes net loss from cumulative effect of changes in accounting for health benefits for retirees and for income taxes of $2.0 million ($0.02 per share). d Excludes net gain from cumulative effect of change in accounting for income taxes of $43.0 million ($0.45 per share). e Excludes net gain from cumulative effects of changes in accounting for health benefits for retirees, pensions, and income taxes of $2.1 million ($0.07 per share). f Net loss. g Per partnership preference unit. h Excludes net loss from cumulative effect of changes in accounting for health benefits of retirees and for income taxes of $26.1 million ($1.39 per share). i From continuing operations; excludes net income from discontinued operations of $9.5 million ($0.45 per share) and net gain on disposition of discontinued operations of $77.9 million ($3.66 per share).

Year	Net sales	Net income	Total assets	Net plant and equipment	Capital expenditures	Stockholders' equity	NET INCOME % of sales	NET INCOME % of stockholders' equity	NET INCOME $ per share	Dividends, $ per share	Dividend yield, % of price	Stock price range, $ per share	Price-earnings ratio
					(Money figures in millions of dollars unless otherwise indicated)								
Crompton & Knowles													
1993[a]	$558	$52.0	$330	$99.9	$14.3	$207	9.3%	25.1%	$1.00	$0.38	1.7%	$27¼–17⅝	22.4
1992	518	43.3[a]	316	98.8	12.8	177	8.4	24.5	0.87[a]	0.31	1.6	23⅞–16	22.9
1991	450	35.9	276	80.2	11.4	108	8.0	33.2	0.73	0.25	1.6	20¼–8⅜	21.8
1990	390	30.0	252	76.7	16.4	87	7.7	34.5	0.61	0.195	2.1	11½–6⅝	15.0
Dexter													
1993	$887	$34.1[b]	$748	$310.0	$47.0	$244	3.8%	14.0%	$1.40[b]	$0.88	3.6%	$28⅞–20⅜	17.6
1992	951	38.2	726	298.9	52.0	260	4.0	14.7	1.58	0.88	3.6	28⅛–20⅞	15.5
1991	938	(7.1)[c]	721	299.3	61.5	250	—	—	(0.29)[c]	0.88	3.9	26⅛–18½	—
1990	908	42.1	697	274.1	43.9	278	4.6	15.1	1.74	0.88	4.1	24½–18	12.2
Dow Chemical													
1993	$18,060	$644.0	$21,071	$8,580.0	$1,397.0	$3,600	3.6%	17.9%	$2.33	$2.60	4.7%	$62–49	23.8
1992	18,971	276.0[d]	20,978	8,801.0	1,595.0	3,682	1.5	7.5	0.99[d]	2.60	4.6	62⅞–51¼	57.6
1991	18,807	942.0	20,418	8,775.0	1,908.0	5,132	5.0	18.4	3.46	2.60	5.1	58–44⅛	14.8
1990	19,773	1,384.0	19,764	8,249.0	2,119.0	4,539	7.0	30.5	5.10	2.60	4.6	75¾–37	11.1
DuPont													
1993	$37,098	$555.0	$36,775	$21,423.0	$3,621.0	$10,952	1.5%	5.1%	$0.81	$1.76	3.6%	$53⅞–44½	60.7
1992	37,799	975.0[e]	38,409	21,882.0	4,448.0	11,304	2.6	8.6	1.43[e]	1.74	3.5	54⅞–43½	34.4
1991	38,695	1,403.0	35,596	20,610.0	5,065.0	16,218	3.6	8.7	2.08	1.68	4.1	50–32¾	19.9
1990	40,047	2,310.0	37,332	21,102.0	5,383.0	15,622	5.8	14.8	3.40	1.62	4.3	42⅜–31⅜	10.8
Ethyl													
1993[f]	$1,938	$90.0[g]	$2,009	$998.3	$205.0	$640	4.6%	14.1%	$0.76[g]	$0.60	2.5%	$30⅞–16¾	31.3
1992	2,975	269.4[h]	9,070	829.8	157.4	1,267	9.1	21.3	2.27[h]	0.60	2.2	30½–23¾	11.9
1991	2,575	206.7	7,785	766.7	166.1	1,100	8.0	18.8	1.75	0.60	2.2	33–22¼	15.8
1990	2,514	232.2	6,589	677.0	151.8	947	9.2	24.5	1.95	0.60	2.2	33–20½	13.7
Ferro													
1993	$1,066	$57.5[i]	$714	$257.8	$43.7	$305	5.4%	18.9%	$1.83[i]	$0.51	1.7%	$34¾–26⅛	16.6
1992	1,098	58.8	674	227.6	44.8	323	5.4	18.2	1.90	0.45	1.6	31½–23½	14.5
1991	1,057	36.5[j]	668	234.7	39.0	301	3.5	12.1	1.16[j]	0.43	2.4	25⅝–10⅛	15.4
1990	1,125	19.4	672	255.9	59.7	292	1.7	6.6	0.55	0.43	2.7	19½–11½	28.1
First Mississippi													
1993[k,l]	$430	$2.7[m]	$384	$206.1	$39.1	$161	0.6%	1.7%	$0.13[m]	$0.30	3.2%	$11¾–7¼	73.1
1992[k]	525	4.2	468	277.3	33.6	188	0.8	2.2	0.21	0.30	2.6	14⅞–8	54.5
1991[k]	537	5.3	476	294.6	47.2	188	1.0	2.8	0.27	0.30	3.0	12⅝–7¾	37.3
1990[k]	498	4.4	512	310.0	64.6	190	0.9	2.3	0.22	0.30	1.9	19¼–11⅝	70.2
FMC													
1993	$3,754	$41.0[n]	$2,721	$1,390.2	$244.5	$125	1.1%	32.8%	$1.11[n]	0	—	$53–41½	42.7
1992	3,974	192.6[o]	2,763	1,502.1	314.5	156	4.8	123.5	5.04[o]	0	—	53–42⅝	9.5
1991	3,899	173.1[p]	2,753	1,484.2	216.8	247	4.4	70.1	4.68[p]	0	—	51⅝–29½	8.7
1990	3,722	155.3	2,889	1,507.1	324.3	79	4.2	196.6	4.30	0	—	38¾–25⅜	7.5
H. B. Fuller													
1993[q]	$975	$21.7[r]	$544	$232.5	$41.8	$229	2.2%	9.5%	$1.55[r]	$0.54	1.5%	$42¾–31¼	23.9
1992[q]	934	35.6	543	223.2	34.4	237	3.8	15.0	2.55	0.46	1.1	53¼–32⅝	16.8
1991[q]	853	27.7	484	207.4	30.0	194	3.2	14.3	2.00	0.41	1.4	38⅜–18⅞	14.3
1990[q]	792	21.1	468	202.3	31.5	175	2.7	12.1	1.53	0.40	2.4	19⅛–13¾	10.7
Georgia Gulf													
1993	$769	$42.2[s]	$406	$222.8	$29.6	$(111)[t]	5.5%	—	$1.01[s]	0	—	$23¾–16½	19.9
1992	779	46.3	419	211.7	14.3	(161)[t]	5.9	—	1.18	0	—	28⅝–15¾	12.7
1991	838	61.5	416	220.6	28.3	(358)[t]	7.3	—	1.75	0	—	24¾–8⅞	9.6
1990	932	95.3	457	214.7	58.1	(424)[t]	10.2	—	3.07	0	—	11–4⅞	2.6
BF Goodrich													
1993[u]	$1,818	$15.3[v]	$1,781	$836.0	$146.2	$316	0.8%	4.8%	$0.28[w]	$2.20	4.7%	$53⅞–39½	166.7
1992	2,526	(9.4)[c,w]	2,206	1,215.8	200.2	583	—	—	(0.69)[c,w]	2.20	4.5	58⅛–38⅞	—
1991	2,472	(80.6)[c]	2,038	1,171.0	211.2	989	—	—	(3.50)[c]	2.20	5.3	47⅝–36	—
1990	2,433	115.8[x]	2,198	1,109.3	243.0	1,200	4.8	9.6	4.20[x]	2.12	5.5	47⅜–29½	9.2

a Excludes net loss from early extinguishment of debt of $3.0 million ($0.06 per share) and net loss from cumulative effect of changes in accounting for health benefits for retirees of $5.8 million ($0.12 per share). **b** Excludes net loss from cumulative effect of changes in accounting for health benefits for retirees and income taxes of $9.9 million ($0.41 per share). **c** Net loss. **d** Excludes net loss from cumulative effect of changes in accounting for health benefits for retirees and for income taxes of $765.0 million ($2.82 per share). **e** Excludes net loss from early extinguishment of debt and from cumulative effect of changes in accounting for health benefits for retirees and for income taxes of $4.90 billion ($7.28 per share). **f** Excludes insurance business, spun off in 1993. In 1992, this business contributed $162.5 million to net income; spin-off reduced stockholders' equity by $677.5 million. Company data for 1992 and earlier years have not been restated. **g** Excludes extraordinary loss for early retirement of debt of $5.0 million ($0.04 per share). **h** Excludes net loss from cumulative effect of changes in accounting for health benefits for retirees and for income taxes of $14.4 million ($0.12 per share). **i** Excludes net loss from cumulative effect of changes in accounting for health benefits for retirees and income taxes of $20.5 million ($0.70 per share). **j** Excludes restructuring charge, after taxes, of $31.7 million ($1.11 per share). **k** Fiscal year ends June 30. **l** Excludes coal, oil, and certain other technology businesses discontinued in the 1992–93 fiscal year. In the year ending June 30, 1992, these businesses contributed $71.5 million to net sales and decreased net income by $11.9 million. Company data for 1992 and earlier years have not been restated. **m** From continuing operations; excludes loss from discontinued coal, oil, and other technology businesses of $26.0 million ($1.30 per share). **n** Excludes net loss for early retirement of debt of $4.7 million ($0.13 per share). **o** From continuing operations; excludes loss from discontinued operations of $73.2 million ($1.99 per share), also excludes extraordinary loss for early retirement of debt of $11.4 million ($0.31 per share) and for cumulative effect of changes in accounting for health benefits for retirees of $183.7 million ($4.99 per share). **p** Excludes extraordinary loss from refinancing debt of $9.2 million ($0.25 per share). **q** Fiscal year ends Nov. 30. **r** Excludes net loss from cumulative effect of changes in accounting for health benefits for retirees and for income taxes of $11.7 million ($0.84 per share). **s** Excludes extraordinary loss for early retirement of debt of $13.3 million ($0.32 per share) and net gain from cumulative effect of change in accounting for income taxes of $13.0 million ($0.32 per share). **t** Deficit. **u** Excludes major portion of vinyl business, spun off as a separate company in 1993. In 1992, this business contributed $894.3 million to net sales and decreased income by $79.6 million; spin-off did not affect stockholders' equity. Company data for 1992 and earlier years have not been restated. **v** From continuing operations; excludes gain from sale of vinyl business of $113.0 million ($4.40 per share). **w** Excludes net loss from cumulative effect of changes in accounting for health benefits for retirees of $286.5 million ($11.21 per share). **x** From continuing operations; excludes income from discontinued operations of $20.5 million ($0.25 per share).

FINANCES OF THE U.S. CHEMICAL INDUSTRY

Year	Net sales	Net income	Total assets	Net plant and equipment	Capital expenditures	Stockholders' equity	NET INCOME % of sales	NET INCOME % of stockholders' equity	NET INCOME $ per share	Dividend, $ per share	Dividend yield, % of price	Stock price range, $ per share	Price-earnings ratio
					(Money figures in millions of dollars unless otherwise indicated)								
W. R. Grace													
1993	$4,408	$134.4[a]	$5,627	$1,454.1	$309.6	$1,036	3.0%	13.0%	$1.46[a]	$1.40	3.7%	$41¼–34⅝	26.0
1992	5,518	79.4[b]	5,300	1,707.9	398.4	1,246	1.4	6.4	0.88[b]	1.40	3.6	45–32	43.8
1991	6,049	219.2[c]	5,698	2,558.2	447.0	1,744	3.6	12.6	2.51[c]	1.40	4.4	40¾–23⅜	12.8
1990	6,754	202.8	5,876	2,462.1	513.7	1,562	3.0	13.0	2.36	1.40	5.5	33⅜–17	10.7
Great Lakes Chemical													
1993	$1,792	$272.8	$1,560	$468.0	$79.3	$916	15.2%	29.8%	$3.82	$0.35	0.5%	$84–64½	19.4
1992	1,496	232.7	1,432	429.8	69.4	753	15.6	30.9	3.27	0.31	0.5	71⅜–50¼	18.6
1991	1,308	157.5	1,420	405.6	71.2	672	12.0	23.4	2.23	0.27	0.6	58–30⅛	19.8
1990	1,066	140.8	1,201	363.7	48.6	538	13.2	26.2	2.00	0.23	0.9	33⅞–20⅜	13.3
Hercules													
1993	$2,773	$208.4[d]	$3,162	$1,309.3	$149.5	$1,368	7.5%	15.2%	$4.86[d]	$2.24	2.5%	$114⅞–63¼	18.3
1992	2,865	167.9	3,228	1,348.3	150.1	1,746	5.9	9.6	3.69	2.24	4.1	63¾–44⅛	14.7
1991	2,929	94.9	3,467	1,476.3	214.5	1,918	3.2	4.9	2.01	2.24	5.5	50⅜–31¾	20.4
1990	3,200	96.0	3,700	1,449.9	272.6	1,942	3.0	4.9	2.04	2.24	6.7	41½–25⅝	16.5
IMC Fertilizer Group													
1993[e]	$897	($120.0)[f,g]	$2,056	$1,326.5	$106.1	$430	--	—	($5.44)[f,g]	$0.81	2.3%	$45⅞–24⅜	—
1992[e]	1,059	90.9[h]	1,778	1,266.8	177.7	615	8.6%	14.8%	4.12[h]	1.08	2.0	68–42⅜	13.4
1991[e]	1,131	95.8	1,739	1,220.9	168.5	699	8.5	13.7	3.85	1.08	2.3	60–33	12.1
1990[e]	1,106	82.6	1,585	1,144.1	94.3	820	7.5	10.1	3.13	1.08	3.0	39¾–31⅛	11.3
International Flavors & Fragrances													
1993	$1,189	$202.4	$1,225	$323.4	$82.3	$892	17.0%	22.7%	$1.78	$1.02	3.3%	$39⅞–33	20.5
1992	1,126	176.6[i]	1,268	286.4	51.1	977	15.7	18.1	1.53[i]	0.93	2.6	38¾–31½	23.0
1991	1,017	168.7	1,217	289.6	54.1	960	16.6	17.6	1.47	0.83	2.8	35–23	19.7
1990	963	156.7	1,129	266.9	42.9	898	16.3	17.4	1.37	0.74	3.3	25–18¼	15.8
International Specialty Products													
1993	$548	$29.6	$786	$478.5	$62.9	$77	5.4%	38.4%	$0.30	$0.05	12.9%	$9¾–5¾	25.8
1992	571	57.2[j]	800	452.1	70.5	46	10.0	12.4	0.57[j]	0.05	4.0	15⅞–8¼	21.6
1991[k]	526	50.6	667	415.3	34.4	0	9.6	—	0.56	0	—	16⅛–11½[l]	28.3
Loctite													
1993	$613	$68.3	$523	$164.5	$46.3	$278	11.1%	24.6%	$1.92	$0.79	2.0%	$45⅝–34¼	20.9
1992	608	72.3	479	139.0	40.2	305	11.9	23.7	1.99	0.74	1.6	50⅞–39⅝	22.7
1991	561	71.9	447	120.6	33.5	279	12.8	25.8	1.91	0.68	1.7	50⅛–28	19.7
1990	555	67.4	458	104.0	29.4	289	12.1	23.3	1.82	0.59	2.3	30¾–20⅝	13.8
Lubrizol													
1993	$1,518	$85.0[m]	$1,146	$437.6	$127.9	$696	5.6%	12.2%	$1.25[m]	$0.85	2.7%	$36⅛–26⅝	25.2
1992	1,545	124.6	1,112	375.6	95.8	804	8.1	15.5	1.81	0.81	2.7	34⅞–24⅝	16.4
1991	1,468	123.7	1,154	380.0	82.4	777	8.4	15.9	1.78	0.77	3.0	29¼–22	14.5
1990	1,445	127.1[n]	1,097	353.6	77.4	718	8.8	17.7	1.77[n]	0.73	3.6	24½–16½	11.5
Monsanto													
1993	$7,902	$494.0	$7,451	$2,802.0	$437.0	$1,666	6.3%	29.7%	$4.10	$2.30	3.7%	$75–48⅞	15.1
1992	7,763	(126.0)[f,o]	8,019	3,005.0	586.0	1,939	—	—	(101)[f,o]	2.20	3.6	71¼–49¾	—
1991	8,864	296.0[p]	7,937	3,362.0	591.0	2,364	3.3	12.5	2.33[p]	2.045	3.4	76–46	26.2
1990	8,995	546.0[q]	7,811	3,492.0	750.0	2,664	6.1	20.5	4.23[q]	1.88	3.8	60⅛–38¼	11.7
Morton International													
1993[e]	$2,310	$126.9[r]	$1,894	$914.3	$201.4	$856	5.5%	14.8%	$2.57[r]	$0.96	1.5%	$79⅛–50¼	25.3
1992[e]	2,044	144.5	1,755	835.2	200.1	867	7.1	16.7	2.95	0.96	1.6	64⅞–51¾	19.8
1991[e]	1,906	138.3	1,563	722.3	163.6	741	7.3	18.7	2.85	0.94	2.0	57⅜–35⅛	16.3
1990[e]	1,639	129.0[s]	1,448	646.2	113.3	642	7.9	20.1	2.68[s]	0.86	2.3	44¼–31½	14.2
Nalco Chemical													
1993	1,389	$152.7[t]	$1,212	$558.5	$117.8	$438	11.0%	34.9%	$1.88[t]	$0.885	2.6%	$37⅞–30¼	18.1
1992	1,375	145.0	1,232	533.3	131.0	458	10.5	31.7	1.90	0.84	2.4	40⅞–30⅜	18.8
1991	1,237	134.6[u]	1,186	493.6	136.8	390	10.9	34.5	1.78[u]	0.83	2.4	42¼–26⅛	19.2
1990	1,212	131.1	992	419.3	114.9	410	10.8	31.9	1.71	0.755	2.9	30⅝–22	15.4

a From continuing operations; excludes loss from disposal of cocoa, battery separators, certain engineered materials, and other businesses of $108.4 million ($1.18 per share). **b** From continuing operations; excludes net loss from discontinued operations of $183.9 million ($2.05 per share) and net loss from cumulative effect of changes in accounting for health benefits for retirees of $190.0 million ($2.12 per share). **c** From continuing operations; excludes net loss from discontinued operations of $0.6 million ($0.01 per share). **d** Excludes losses from early retirement of debt and from cumulative effect of changes in accounting for health benefits to retirees and for income taxes of $241.8 million ($5.63 per share). **e** Fiscal year ends June 30. **f** Net loss. **g** Excludes net loss from cumulative effect of changes in accounting for health benefits for retirees of $47.1 million ($2.13 per share). **h** Excludes net loss from cumulative effect of changes in accounting for income taxes of $165.5 million ($4.12 per share). **i** Excludes net loss from cumulative effect of changes in accounting for health benefits for retirees and for income taxes of $6.1 million ($0.16 per share). **j** Excludes net loss from cumulative effect of changes in accounting for health benefits for retirees of $7.1 million ($0.07 per share). **k** Became a publicly held company June 21, 1991; prior to that was part of GAF; data for earlier part of 1991 are pro forma. **l** From June 21 only. **m** Excludes net loss from cumulative effect of changes in accounting for health benefits for retirees and for income taxes of $39.4 million ($0.58 per share), but includes special charge for shutting down certain manufacturing units and reducing personnel of $36.3 million ($0.83 per share) and a gain from the sale of Genentech stock of $42.4 million ($0.41 per share). **n** From continuing operations; excludes gain, after taxes, on sale of Genentech stock of $62.9 million ($1.79 per share) but includes charge for write-off of inventories and receivables due from a former affiliate of $9.7 million. **o** From continuing operations; excludes income and gain from sale of Fisher Controls of $578.0 million ($4.68 per share) and net loss from cumulative effect of changes in accounting for health benefits for retirees and for income taxes of $658.0 million ($4.38 per share). **p** Includes net restructuring expense of $325.0 million ($2.54 per share). **q** Includes net gain on divestitures of $56 million ($0.43 per share). **r** Excludes net loss from cumulative effect of changes in accounting for health benefits for retirees and future costs of disability benefits of $94.4 million ($1.91 per share). **s** Excludes extraordinary net gains of $5.8 million ($0.12 per share). **t** Excludes net losses from retirement of debt of $10.6 million ($0.15 per share) and from cumulative effect of change in accounting for health benefits for retirees of $56.5 million ($0.81 per share). **u** From continuing operations; excludes net income from discontinued operations of $3.2 million ($0.04 per share).

Year	Net sales	Net income	Total assets	Net plant and equipment	Capital expenditures	Stockholders' equity	NET INCOME % of sales	NET INCOME % of stockholders' equity	NET INCOME $ per share	Dividend, $ per share	Dividend yield, % of price	Stock price range, $ per share	Price-earnings ratio
						(Money figures in millions of dollars unless otherwise indicated)							
NL Industries													
1993	$805	$(83.2)[a,b]	$1,191	$378.6	$48.0	$(280)[c]	—	—	$(1.63)[a,b]	0	—	$6⅛–3⅜	—
1992	893	(44.6)[a,d]	1,453	746.0	85.2	(165)[c]	—	—	(0.88)[a,d]	$0.35	4.1%	12⅞–4	—
1991	840	(24.0)[a,e]	1,808	738.6	195.1	(81)[c]	—	—	(0.40)[a,e]	0.60	4.8	16¾–8½	—
1990	907	93.5[f]	1,941	577.1	195.3	13	10.3%	719.2%	1.42[f]	0.60	3.5	24¾–9¼	12.0
Occidental Petroleum													
1993	$8,116	$74.0[g]	$17,123	$14,284.0	$1,083.0	$3,958	0.9%	1.9%	$0.12[g]	$1.00	5.0%	$23½–16⅞	168.2
1992	8,494	126.0[h]	17,877	14,051.0	860.0	3,440	1.5	3.7	0.41[h]	1.00	5.1	23⅛–15¾	47.4
1991	9,498	317.0[i]	15,763	11,279.0	1,007.0	4,340	3.3	7.7	1.04[i]	1.00	4.8	25⅜–16½	20.1
1990	21,694	(1,695.0)[a]	19,743	13,887.0	1,446.0	4,112	—	—	(5.82)[a]	2.50	10.4	30¼–17¾	—
Olin													
1993	$2,423	$(92.0)[a]	$1,816	$885.0	$132.0	$482	—	—	$(4.52)[a]	$2.20	4.9%	$50½–39⅞	—
1992	2,376	55.0[j]	1,904	934.0	173.0	615	2.3%	8.9%	2.17[j]	2.20	4.8	54¾–37¼	21.2
1991	2,275	67.0[k]	1,880	899.0	177.0	534	2.9	12.5	3.32[k]	2.20	5.0	54–33½	13.2
1990	2,592	84.0	1,760	829.0	187.0	609	3.2	13.8	4.03	2.15	4.8	60⅝–28⅛	10.7
Praxair[l]													
1993	$2,438	$143.0[m]	$3,188	$2,273.0	$240.0	$568	5.9%	25.2%	$1.06[m]	$0.25	1.5%	$18¼–15	15.7
1992	2,604	84.0[n]	3,283	2,315.0	333.0	483	3.2	17.4	0.64[n]	0.25[o]	1.6[o]	17⅛–13⅜[p]	24.0[o]
1991	2,469	107.0	3,417	2,338.0	417.0	616	4.3	17.4	—	—	—	—	—
Rohm and Haas													
1993	$3,269	$126.0[q]	$3,394	$1,869.0	$382.0	$1,311	3.9%	9.6%	$1.74[q]	$1.36	2.5%	$62–47¼	31.4
1992	3,063	174.0[r]	3,297	1,768.0	283.0	1,280	5.7	13.6	2.53[r]	1.28	2.5	59⅝–42¾	20.2
1991	2,763	163.0	2,867	1,470.0	265.0	1,201	5.9	13.6	2.45	1.24	3.1	48½–32¾	16.6
1990	2,824	207.0[s]	2,645	1,390.0	412.0	1,176	7.3	17.6	3.10[s]	1.22	4.0	37–24¼	9.9
Sigma-Aldrich													
1993	$739	$107.2[t]	$753	$257.3	$75.2	$591	14.5%	18.1%	$2.15[t]	$0.30	0.6%	$58–44½	23.8
1992	654	95.5	616	188.3	30.9	512	14.6	18.7	1.92	0.26	0.5	59¼–41¾	26.3
1991	589	79.8	597	191.7	26.1	441	13.5	18.1	1.60	0.23	0.6	53–28	25.3
1990	529	71.2	546	192.4	32.5	368	13.5	19.3	1.44	0.205	0.7	35⅛–25⅛	21.1
Stepan													
1993	$439	$10.8	$300	$168.9	$25.4	$104	2.5%	10.4%	$1.92	$0.81	2.6%	$37⅝–25⅛	16.3
1992	436	10.4[u]	297	167.9	34.4	100	2.4	10.4	1.91[u]	0.74	2.1	45¾–26¼	18.8
1991	414	12.5	271	157.1	33.7	91	3.0	13.8	2.30	0.66	2.6	29¾–21⅜	11.1
1990	390	14.5	247	143.3	38.4	83	3.7	17.5	2.64	0.58	2.6	27¼–16⅝	8.3
Sterling Chemicals													
1993[v]	$519	$(5.4)[a]	$482	$314.3	$12.2	$13	—	—	$(0.10)[a]	$0.06	1.5%	$5–3⅛	—
1992[v]	431	4.5[w]	536	343.8	16.0	24	1.0%	18.8%	0.08[w]	0.245	4.2	5⅛–3⅞	71.9
1991[v]	543	36.8	361	230.6	34.4	112	6.8	32.8	0.67	0.65	11.2	7⅛–4½	8.7
1990[v]	506	59.1	352	216.0	19.9	108	11.7	54.6	1.07	1.00	14.4	8⅝–5¼	6.5
Union Carbide													
1993	$4,640	$165.0[x]	$4,645	$2,420.0	$395.0	$1,384	3.6%	11.9%	$1.00[x]	$0.75	3.8%	$23⅛–16	19.6
1992	4,872	119.0[y]	4,856	2,539.0	359.0	1,153[z]	2.4	10.3	0.76[y]	0.875[z]	6.3	17⅛–10⅞	18.4
1991[aa]	4,877	(116.0)[a]	6,705	2,499.0	400.0	2,118	—	—	(1.06)[a]	1.00	5.3	22⅝–15⅛	—
1990	7,621	308.0[bb]	8,587	4,325.0	744.0	2,227	4.0	13.8	2.19[bb]	1.00	5.1	24⅞–14⅛	8.9
Witco													
1993	$2,143	$19.8	$1,622	$696.5	$103.7	$496	0.9%	4.0%	$0.46	$0.94	3.3%	$32¼–24	61.1
1992	1,729	53.9[cc]	1,562	721.2	72.6	364	3.1	14.8	1.19[cc]	0.92	4.1	25½–20	19.1
1991	1,631	73.5	1,129	474.8	74.3	556	4.5	13.2	1.605	0.89	4.9	22–14½	11.4
1990	1,631	68.0	1,136	471.0	90.8	544	4.2	12.5	1.475	0.86	5.6	20–10⅞	10.4

a Net loss. b Excludes net loss from retirement of debt of $27.8 million ($0.55 per share) and net gain from cumulative effect of changes in accounting for marketable securities of $1.2 million ($0.02 per share). c Deficit. d Excludes extraordinary net loss from cumulative effect of changes in accounting for health benefits for retirees and other extraordinary items of $43.5 million ($0.62 per share). e Excludes extraordinary net gain of $7.5 million ($0.13 per share). f Excludes extraordinary net loss of $1.1 million ($0.02 per share). g From continuing operations; excludes net income from sale of coal business of $221 million ($0.72 per share); also excludes net loss from early retirement of debt of $12 million ($0.04 per share). h From continuing operations; excludes net loss from discontinued coal business of $622 million ($2.06 per share); also excludes loss from early retirement of debt of $2 million ($0.01 per share) and from cumulative effect of changes in accounting for health benefits for retirees and for income taxes of $93 million ($0.31 per share). i From continuing operations; excludes extraordinary gain on sale of agricultural business of $143 million ($0.48 per share). j Excludes net loss from cumulative effect of changes in accounting for health benefits for retirees and for income taxes of $46.0 million ($2.11 per share). k Excludes special charge for restructuring of operations of $80 million ($4.24 per share). l Became an independent company on June 30, 1992; prior to that was part of Union Carbide; data for 1991 and the first half of 1992 are pro forma and are not included in Union Carbide data. m Excludes net loss from cumulative effect of change in accounting for health benefits of retirees and for income taxes of $144 million ($1.10 per share). n Excludes net loss from cumulative effect of changes in accounting for health benefits of retirees and for income for future severance benefits for employees of $25 million ($0.19 per share). o On full-year basis. p From June 30 only. q Excludes net loss from cumulative effect of changes in accounting for future costs of disability benefits of $19 million ($0.28 per share). r Excludes net loss from cumulative effect of changes in accounting for health benefits for retirees of $179.0 million ($2.69 per share). s Includes net gain on sale of surfactant and alkylphenol businesses of $26 million ($0.39 per share), on sale of forest property of $20 million ($0.20 per share), and net loss for write-off of intangible assets in electronic materials business of $187 million ($0.27 per share). t Excludes net loss from cumulative effect of changes in accounting for health benefits for retirees and for income taxes of $10.8 million ($0.22 per share). u Excludes net gain from changes in accounting for income taxes and investment tax credits of $5.4 million ($1.02 per share). v Fiscal year ends Sept. 30. w Excludes net loss from changes in accounting for health benefits for retirees of $10.4 million ($0.19 per share). x Excludes net loss from cumulative effect of changes in accounting for future severance benefits for employees of $97 million ($0.64 per share). y From continuing operations; excludes net gain from spin-off of industrial gases business of $67.0 million ($0.51 per share) and net loss from cumulative effect of changes in accounting for health benefits for retirees and for income taxes of $361.0 million ($2.73 per share). z On June 30, stockholders received one share in the newly formed industrial gases company Praxair for every share of Union Carbide stock; the effect of this spin-off was to reduce Union Carbide stockholders' equity by $733.0 million. aa Excludes industrial gases business, spun off during 1992. bb Includes net loss from sale of 50% interest in carbon product business of $86 million ($0.61 per share) and net gain from sale of other businesses of $80 million ($0.57 per share). cc Excludes net loss from cumulative effect of changes in accounting for health benefits for retirees and for income taxes of $14.7 million ($0.59 per share).

FINANCES OF THE U.S. CHEMICAL INDUSTRY

Year	Net sales	Net income	Total assets	Net plant and equipment	Capital expenditures	Stockholders' equity	NET INCOME % of sales	NET INCOME % of stockholders' equity	NET INCOME $ per share	Dividends, $ per share	Dividend yield, % of price	Stock price range, $ per share	Price-earnings ratio
						(Money figures in millions of dollars unless otherwise indicated)							
PHARMACEUTICALS													
Abbott Laboratories													
1993	$8,408	$1,399.1	$7,689	$3,511.0	$952.7	$3,675	16.6%	38.1%	$1.69	$0.68	2.5%	$30⅞–22⅝	15.8
1992	7,852	1,239.1	6,941	3,099.2	1,007.2	3,348	15.8	37.0	1.47	0.60	2.0	34⅛–26⅛	20.5
1991	6,877	1,088.7[a]	6,255	2,662.1	770.6	3,203	15.8	34.0	1.28[a]	0.50	1.8	34¾–19⅝	21.3
1990	6,159	965.8	5,563	2,375.8	641.4	2,834	15.7	34.1	1.11	0.42	2.2	23¼–15⅝	17.5
American Cyanamid													
1993[b]	$4,277	($163.7)[c,d]	$5,752	$1,770.3	$305.5	$1,062	—	—	($1.82)[c,d]	$1.725	3.3%	$59¼–46	—
1992	5,268	395.1	5,209	2,119.8	410.0	2,518	7.5%	15.7%	4.35	1.61	2.7	66⅜–52⅛	13.6
1991	4,986	358.8	4,838	2,018.9	392.1	2,387	7.2	15.0	3.85	1.46	2.5	69–48½	15.3
1990	4,570	107.8[e]	4,864	1,906.0	375.5	2,335	2.4	4.6	1.15[e]	1.35	2.2	61½–42	5.3
American Home Products													
1993	$8,305	$1,469.3	$6,971	$2,059.8	$517.9	$3,160	17.7%	46.5%	$4.73	$2.86	4.6%	$69–55½	13.2
1992	7,874	1,150.7[f]	6,433	1,777.8	428.1	2,854	14.6	40.3	3.66[f]	2.66	3.6	84¼–63¼	20.2
1991	7,079	1,375.3	5,684	1,476.8	227.9	3,046	19.4	45.2	4.36	2.375	3.6	86¼–47⅛	15.3
1990	6,775	1,230.6[g]	5,354	1,437.4	247.7	2,392	18.2	51.4	3.92[g]	2.15	4.3	55–44	12.6
Bristol-Myers Squibb													
1993	$11,413	$1,959.0	$11,910	$3,374.0	$570.0	$5,749	17.2%	34.1%	$3.80	$2.88	4.9%	$67¼–50⅞	15.5
1992	11,727	1,603.0[h]	10,651	3,141.0	647.0	5,867	13.7	27.3	3.09[h]	2.76	3.7	90⅛–60	24.3
1991	11,159	2,056.0	9,246	2,936.0	633.0	5,625	18.4	36.6	3.95	2.40	3.2	89⅜–61⅛	19.1
1990	10,300	1,748.0	9,023	2,631.0	526.0	5,226	17.0	33.4	3.33	2.12	3.6	68–50½	17.8
Johnson & Johnson													
1993	$14,138	$1,787.0	$11,317	$4,406.0	$975.0	$4,643	12.6%	38.5%	$2.74	$1.01	2.3%	$50⅜–35⅝	15.7
1992	13,753	1,625.0[i]	11,168	4,115.0	1,103.0	4,455	11.8	36.5	2.46[i]	0.89	1.7	58¾–43	20.7
1991	12,447	1,461.0	9,775	3,667.0	987.0	4,888	11.7	29.9	4.39	0.77	1.7	58⅛–32⅛	20.7
1990	11,232	1,143.0[j]	9,506	3,247.0	830.0	4,900	10.2	23.3	3.43[j]	0.655	2.1	37–25½	18.3
Eli Lilly													
1993	$6,452	$491.1[k]	$9,624	$4,200.2	$633.5	$4,164	7.6%	11.8%	$1.67[k]	$2.42	4.5%	$62–45	32.0
1992	6,167	827.6[l]	8,213	4,072.1	912.9	4,440	13.4	18.6	2.81[l]	2.20	3.0	87¾–57¾	25.8
1991	5,726	1,314.7	7,873	3,782.5	1,142.4	4,540	23.0	29.0	4.50	2.00	2.6	84⅞–69	17.1
1990	5,192	1,127.3	6,674	2,936.7	1,007.3	2,998	21.7	37.6	3.90	1.64	2.2	89¼–59⅜	19.1
Merck													
1993	$10,498	$2,166.2	$13,282	$4,894.6	$1,012.7	$3,376	20.6%	64.2%	$1.87	$1.03	2.8%	$44⅛–25⅝	19.5
1992	9,663	2,446.6[m]	10,933	4,271.1	1,066.6	4,849	25.3	50.5	2.12[m]	0.92	1.9	56⅝–40½	22.9
1991	8,603	2,121.7	9,349	3,504.5	1,041.5	4,767	24.7	44.5	1.83	0.77	1.9	55⅛–27⅜	22.7
1990	7,671	1,781.2	7,873	2,721.7	670.8	3,677	23.3	48.4	1.52	0.64	2.4	30⅜–22⅜	17.3
Pfizer													
1993	$7,478	$657.5	$9,100	$2,632.5	$634.2	$3,634	8.8%	18.1%	$2.05	$1.68	2.6%	$75⅝–52½	31.3
1992	7,230	1,093.5[n]	9,222	2,305.1	674.2	4,350	15.1	25.1	3.25[n]	1.48	1.9	87–65⅛	23.4
1991	6,950	917.1[o]	9,251	2,381.0	593.8	4,643	13.2	19.8	2.71[o]	1.32	2.1	86⅛–36¾	22.7
1990	6,406	801.2	8,553	2,109.8	547.5	4,593	12.5	17.4	2.38	1.20	3.5	40⅞–27¼	14.3
Schering-Plough													
1993	$4,341	$825.0[p]	$4,134	$1,967.7	$365.2	$1,399	19.0%	59.0%	$4.23[p]	$1.74	2.8%	$71–51¾	14.5
1992	4,056	720.4	3,967	1,748.5	403.2	1,407	17.8	51.2	3.60	1.50	2.5	70⅛–49⅞	16.7
1991	3,616	645.6	3,822	1,490.4	339.4	1,155	17.9	55.9	3.01	1.27	2.4	67⅛–40¼	17.9
1990	3,323	565.1	3,937	1,284.4	242.9	1915	17.0	29.5	2.50	1.065	2.4	50¾–37	17.6
Upjohn													
1993	$3,611	$402.5[q]	$4,816	$1,771.3	$323.5	$2,086	11.1%	19.3%	$2.19[q]	$1.48	4.9%	$35–25⅝	13.8
1992	3,639	547.2[r]	4,605	1,670.4	295.4	2,016	15.0	27.1	3.04[r]	1.42	3.8	45⅞–29⅝	12.4
1991	3,402	537.4	4,147	1,540.7	258.1	2,005	15.8	26.8	2.96	1.26	3.0	49¼–34¾	14.2
1990	3,021	458.1[s]	3,668	1,421.6	246.8	1,780	15.2	25.7	2.48[s]	1.04	2.7	44⅝–33	15.7
Warner-Lambert													
1993	$5,794	$285.0[t]	$4,514	$1,599.3	$347.1	$1,076	4.9%	26.5%	$2.11[t]	$2.28	3.4%	$76⅜–59¾	32.2
1992	5,598	643.7	3,921	1,507.1	334.3	1,372	11.5	46.9	4.78	2.04	3.0	79¼–58⅜	14.4
1991	5,059	452.8[u]	3,444	1,350.0	326.0	1,013	9.0	44.7	4.16[u]	1.76	2.4	82¼–61¾	17.3
1990	4,687	484.9	3,100	1,301.4	239.9	1,241	10.3	39.1	3.61	1.52	2.5	70⅜–49⅝	16.6

a Excludes extraordinary net gain on sale of investment in Amgen of $128.2 million ($0.15 per share). **b** Excludes chemical business, spun off in 1993. In 1992, this business contributed $1,074 million to net sales and $16.0 million to net income; spin-off reduced stockholders' equity by $52.9 million; company data for 1992 and earlier years have not been restated. **c** Net loss. **d** From continuing operations; excludes losses from chemical business, spun off in 1993, of $622.2 million ($6.92 per share); also excludes losses from cumulative effect of changes in accounting for health benefits for retirees and for income taxes of $322.6 million ($3.70 per share). **e** From continuing operations; excludes net income from discontinued operations of $245.0 million ($2.56 per share) but includes special net charge of $206.2 million ($2.15 per share) to consolidate product lines, reduce carrying costs, increase environmental remediation costs, and reduce number of employees. **f** Excludes net loss from cumulative effect of changes in accounting for income taxes and a charge for research acquired from Genetics Institute of $310.1 million ($0.99 per share). **g** Includes gain on sale of household products and depilatory businesses, before taxes, of $999.5 million. **h** From continuing operations; excludes net gain on sale of Drackett of $605.0 million ($1.17 per share) and net loss from cumulative effect of changes in accounting for health benefits for retirees of $246.0 million ($0.47 per share). **i** Excludes net loss from cumulative effect of changes in accounting for health and other benefits for retirees and for income taxes of $595.0 million ($0.90 per share). **j** Includes charge for damage to operations in Latin America of $125 million ($0.38 per share). **k** Excludes net loss from cumulative effect of change in accounting for disability benefits for former employees of $10.9 million ($0.04 per share). **l** Excludes net loss from cumulative effect of changes in accounting for health benefits for retirees and for income taxes of $118.9 million ($0.40 per share). **m** Excludes net loss from cumulative effect of changes in accounting for health and other benefits for retirees and for income taxes of $462.4 million ($0.40 per share). **n** Excludes net loss from cumulative effect of changes in accounting for health benefits for retirees and for income taxes of $282.6 million ($0.84 per share). **o** Excludes special charge for projected payments in connection with potential future Shiley C/C heart valve fractures of $195 million ($0.58 per share). **p** Excludes net loss from cumulative effect of change in accounting for health benefits for retirees of $94.2 million ($0.48 per share). **q** From continuing operations; excludes earnings from and gain from sale of discontinued agricultural chemical business of $8.8 million ($0.04 per share); also excludes net loss from cumulative effect of several accounting changes of $18.9 million ($0.10 per share). **r** Excludes net loss from cumulative effect of changes in accounting for health benefits for retirees and for income taxes of $223.0 million ($1.26 per share). **s** From continuing operations; excludes loss on discontinued operations and their disposal of $2.4 million ($0.01 per share) but includes partial pension settlement net gain of $37.8 million. **t** Excludes net gain from cumulative effect of changes in accounting for disability benefits of former employees and income taxes of $46.0 million ($0.34 per share) but includes nonrecurring restructuring costs of $525.2 million. **u** Excludes nonrecurring net charges for restructuring of $418.0 million ($3.11 per share) and for cumulative effect of accounting change of $106.0 million ($0.79 per share).

Chemical employment tumbled in 1993

Four years of falling earnings and sliding profit margins took their toll on employment in the U.S. chemical industry in 1993. After actually increasing through much of the 1991–92 recession, chemical employment started to slip in the early months of last year. By August, staff cuts had become widespread in the chemical industry, as companies scrambled—usually successfully—to make 1993 more profitable than 1992.

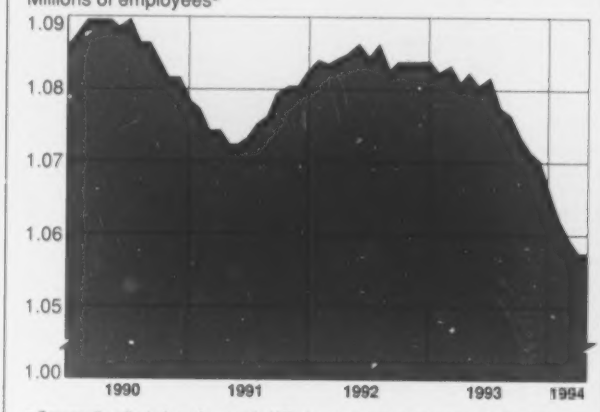
By April 1994, after nine consecutive months of decline, the chemicals and allied products industry set a six-year employment low of a seasonally adjusted 1.057 million, according to figures from the Department of Labor. Preliminary figures for May show that level unchanged, the first indication that the slide may have ended.

If so, the industry's most recent downsizing leaves it with 29,000 fewer employees than it had in August 1992. About 14,000 of those jobs were lost in 1993, most of the rest came in the early months of 1994.

As is usually the case in downsizings, job loss in 1993 was not uniform throughout the chemical industry. It was greatest at the big commodity chemical makers, particularly those that produce industrial organic chemicals and polymers. Total employment at 22 of the largest of these firms fell more than 28,000 in 1993. These companies alone cut many more jobs than did the industry as a whole, and thus the total industry decline would have been larger had not other parts of the industry added to their work force. The biggest gainers, by far, were pharmaceutical companies, which increased their employment 3% during 1993. That growth may have ended, however; drug industry employment held steady through the early months of 1994.

Just what these trends mean for chemists and engineers is uncertain. The National Science Foundation, which keeps track of the number of scientists and engineers in the chemical and other industries, has yet to release 1993 data. NSF expects to do so later this summer. As of January 1992, NSF's latest available survey, more than 82,000 scientists and engineers were working in the chemicals and allied products industries, almost 45% of them at drug firms. At that time, science and engineering employment at drug companies was 8% higher than the previous year; it was 6% lower at industrial chemical companies.

By April 1994, jobs in chemical industry had dropped 3% from their 1992 high



[a] Seasonally adjusted employment in U.S. chemicals and allied products industry; April and May 1994 figures are preliminary. **Source:** Department of Labor

INDUSTRIAL EMPLOYMENT: Drug firms grew in 1993 but chemicals, all industry downsized

Thousands	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	% annual change 1992–93	% annual change 1983–93
All manufacturing	18,432	19,372	19,248	18,947	18,999	19,314	19,391	19,076	18,406	18,040	17,802	−1%	0%
Chemicals & allied products	1,043	1,049	1,044	1,021	1,025	1,057	1,074	1,086	1,076	1,083	1,074	−1	0
Industrial inorganic chemicals	151	143	143	135	131	133	135	138	129	136	135	−1	−1
Plastics materials & synthetics	177	178	172	168	168	177	182	180	178	173	166	−4	−1
Drugs	201	206	206	208	215	228	232	237	247	257	265	3	3
Soap, cleaners & toilet goods	142	146	148	146	152	159	160	159	155	154	157	2	1
Paints & allied products	60	62	63	63	63	63	62	61	58	58	58	0	0
Industrial organic chemicals	163	162	160	154	148	146	150	155	155	154	151	−2	−1
Agricultural chemicals	61	61	59	54	51	52	54	56	57	58	56	−3	−1
Miscellaneous chemical products	89	92	94	93	97	100	99	100	97	94	92	−2	0
Petroleum & coal products	196	189	179	169	164	160	156	157	160	158	151	−4	−2
Rubber & miscellaneous plastics products	743	813	818	823	842	866	888	888	862	872	886	2	2

Note: Average annual domestic employment. **Source:** Department of Labor

PRODUCTION WORKERS: Declines of recent years halted in 1993 in most chemical fields

Thousands	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	% annual change 1992–93	% annual change 1983–93
All manufacturing	12,528	13,280	13,084	12,864	12,952	13,193	13,230	12,947	12,434	12,241	12,143	–1%	–1%
Chemicals & allied products	579	583	578	568	575	596	603	600	580	567	568	0	0
Industrial inorganic chemicals	77	73	72	69	67	69	70	70	64	61	58	–5	–2
Plastics materials & synthetics	115	117	114	113	111	116	119	116	110	104	104	0	–1
Drugs	98	96	95	96	99	101	102	105	109	112	117	4	2
Soap, cleaners & toilet goods	89	93	93	93	97	102	101	98	95	94	96	2	1
Paints & allied products	29	30	31	30	31	31	32	31	30	30	30	0	0
Industrial organic chemicals	84	82	82	81	83	86	88	86	81	76	78	3	–1
Agricultural chemicals	37	38	37	33	32	33	34	34	34	35	33	–6	–1
Miscellaneous chemical products	51	54	54	53	55	58	59	59	58	56	54	–4	1
Petroleum & coal products	118	111	109	106	107	104	102	103	103	103	99	–4	–2
Rubber & miscellaneous plastics products	574	633	632	639	654	675	694	689	663	678	685	1	2

Note: Average annual domestic employment. **Source:** Department of Labor

EMPLOYMENT OF WOMEN: Decade brings greater numbers to all chemical fields

	1982		1992	
	Thousands	% of total	Thousands	% of total
All manufacturing	5,990.0	32%	5,942.0	33%
Chemicals & allied products	279.2	26	334.6	31
Industrial inorganic chemicals	25.2	16	30.3	22
Plastics materials & synthetics	40.4	21	40.3	23
Drugs	85.7	43	116.7	45
Soap, cleaners & toilet goods	58.4	41	68.8	44
Paints & allied products	11.6	19	12.0	21
Industrial organic chemicals	27.4	16	31.5	21
Agricultural chemicals	10.0	15	10.4	18
Miscellaneous chemical products	20.5	23	24.7	26
Petroleum & coal products	31.0	15	26.1	16
Rubber & miscellaneous plastics products	247.8	34	298.2	34

Note: Average annual domestic employment. **Source:** Department of Labor

WORKWEEK: Unchanged for chemicals overall, shorter at drug companies

Hours	1990	1991	1992	1993
All manufacturing	40.8	40.7	41.0	41.4
Chemicals & allied products	42.6	42.9	43.1	43.1
Industrial inorganic chemicals	42.9	43.6	43.5	43.8
Plastics materials & synthetics	42.5	42.6	43.8	44.1
Drugs	41.8	42.5	42.5	41.4
Soap, cleaners & toilet goods	40.8	40.9	41.3	41.9
Paints & allied products	41.9	41.8	41.6	42.2
Industrial organic chemicals	45.2	45.6	45.6	45.4
Agricultural chemicals	44.1	44.4	44.5	44.7
Miscellaneous chemical products	42.4	42.3	42.6	42.8
Petroleum & coal products	44.6	44.1	43.8	44.2
Rubber & miscellaneous plastics products	41.1	41.1	41.7	41.8

Note: For production workers in domestic employment. **Source:** Department of Labor

EMPLOYMENT OF SCIENTISTS, ENGINEERS: Gains at drug firms, losses elsewhere in 1992

Thousands	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Total, all industry	509.8	540.9	584.1	622.5	671.0	695.8	708.6	720.2	730.9	704.1	683.7
Chemicals & allied products	61.6	67.3	69.8	71.1	75.8	75.2	75.8	77.6	78.9	78.8	82.2
Drugs & medicines	25.6	28.2	30.8[b]	30.8	31.8	32.6	33.0	34.0	33.5	34.2	36.9
Industrial chemicals	25.9	26.6	25.6	23.5	24.9	22.4[b]	22.5[b]	23.1[b]	23.0[b]	22.7[b]	21.4[b]
Other chemicals	10.1	12.1	13.4	16.7	19.1	20.2	20.3	20.5	22.4	21.9	23.9
Petroleum refining & extraction	15.6	14.7	13.3	13.5	10.4	9.9	9.5	10.3	10.2	10.0	9.7

Note: Full-time equivalent number of R&D scientists and engineers in industry, as of January of each year. **b** Partly estimated. **Source:** National Science Foundation

CHEMICAL EMPLOYMENT: More than 28,000 jobs cut at major firms in 1993

Thousands	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Air Products	16.7	17.7	18.7	16.5	12.1	13.3	14.1	14.0	14.6	14.5	14.1
Betz Laboratories	2.3	2.5	2.5	2.6	2.0	3.1	3.4	3.7	4.0	4.2	4.1
Cabot	7.2	7.5	7.7	6.6	5.1	5.2	5.5	6.0	5.3	5.4	5.4
Crompton & Knowles	2.4	2.3	2.3	1.3	1.3	1.6	1.7	1.8	2.0	2.2	2.3
Dow Chemical	54.5	49.8	53.2	51.3	53.1	55.5	62.1	62.1	62.2	61.4	55.4
Ethyl	13.0	11.0	10.5	10.5	10.0	10.4	5.5	5.7	6.0	6.3	5.5
H. B. Fuller	4.1	4.3	4.4	4.5	4.6	5.2	5.5	5.6	5.6	5.8	6.0
BF Goodrich	29.4	28.8	26.2	11.9	12.0	12.3	11.9	14.7	14.4	13.4	13.4
W. R. Grace	95.5	102.6	116.9	41.4	39.4	45.7	46.4	49.0	46.6	44.1	34.0
Hercules	24.2	26.3	25.4	25.1	23.2	22.7	23.3	19.9	17.3	15.4	14.1
International Flavors	3.7	3.7	3.7	3.8	4.1	4.2	4.2	4.2	4.2	4.2	4.4
Loctite	2.4	2.5	2.6	2.9	3.2	3.3	3.5	3.7	3.6	3.7	4.0
Lubrizol	4.2	4.2	5.2	4.8	4.8	4.8	5.3	5.2	5.3	4.6	4.6
Monsanto	48.8	50.8	56.1	51.7	49.7	45.6	42.2	41.1	39.3	33.8	30.0
Nalco Chemical	4.6	4.8	5.1	4.9	5.1	5.4	5.5	5.9	6.8	6.7	6.8
Olin	18.2	17.8	14.9	13.2	14.1	16.4	15.4	15.2	14.4	13.5	12.4
PPG Industries	37.0	37.7	37.5	36.5	36.8	36.3	35.5	35.1	33.7	32.3	31.4
Praxair[a]	—	—	—	—	—	—	—	—	—	18.6	16.8
Rohm and Haas	11.4	11.9	11.8	12.1	12.0	12.4	13.0	12.9	12.9	13.8	13.0
Stepan	0.9	0.9	0.9	0.9	1.0	1.0	1.2	1.3	1.3	1.3	1.3
Union Carbide	99.5	98.4	91.5	50.3	43.1	44.0	46.0	38.8	36.7	15.1	13.1
Witco	8.2	8.5	8.1	8.0	7.8	7.6	7.4	7.3	6.9	8.4	8.2
TOTAL EMPLOYEES	**488.2**	**494.0**	**505.2**	**360.9**	**344.5**	**356.0**	**358.6**	**353.2**	**343.1**	**328.7**	**300.3**
ANNUAL CHANGE	**—**	**1.2%**	**2.3%**	**–28.6%**	**–4.5%**	**3.3%**	**0.7%**	**–1.5%**	**–2.9%**	**–4.2%**	**–8.6%**
SALES PER EMPLOYEE ($ thousands)	**$112.4**	**$117.5**	**$104.4**	**$143.7**	**$169.3**	**$191.9**	**$200.1**	**$213.1**	**$204.0**	**$222.3**	**$232.6**

Note: Data are not restated for acquisitions, divestitures, or similar developments. a Spun off from Union Carbide in 1992. **Source:** Company data

WAGES: Rising for chemical production workers except at plastics makers

	Hourly earnings				Weekly earnings			
	1990	1991	1992	1993	1990	1991	1992	1993
All manufacturing	$10.83	$11.18	$11.46	$11.76	$441.86	$455.03	$469.86	$486.86
Chemicals & allied products	13.54	14.04	14.51	14.84	576.80	602.32	625.38	639.60
Industrial inorganic chemicals	14.66	15.05	15.73	16.42	628.91	656.18	684.26	719.20
Plastics materials & synthetics	13.97	14.79	15.37	15.26	593.73	630.05	673.21	672.97
Drugs	12.90	13.49	14.11	14.70	539.22	573.33	599.68	608.58
Soap, cleaners & toilet goods	11.71	12.02	12.00	12.31	477.77	490.42	494.40	515.79
Paints & allied products	11.99	12.48	12.67	12.69	502.38	521.66	527.07	535.52
Industrial organic chemicals	15.97	16.54	17.29	17.67	721.84	754.22	788.42	802.22
Agricultural chemicals	13.73	14.22	14.83	15.11	605.49	632.79	662.90	675.42
Miscellaneous chemical products	12.28	12.61	13.06	13.49	520.67	533.40	556.36	577.37
Petroleum & coal products	16.24	17.04	17.91	18.55	722.30	751.46	784.46	819.91
Rubber & miscellaneous plastics products	9.76	10.07	10.37	10.60	401.14	413.88	432.43	443.08

Note: For production workers in domestic employment. **Source:** Department of Labor

Chemical productivity rose 2.3% last year

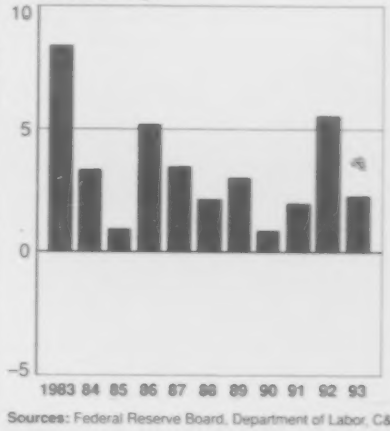
Productivity increased in the U.S. chemical industry last year, marking the 11th straight year that it has done so. But wages for production workers in the chemical industry rose as well. In a sense, they canceled each other out, leaving the costs associated with producing each unit of product unchanged from 1992 levels.

Based on data from the Department of Labor and the Federal Reserve Board, C&EN calculates that chemical industry productivity, which measures the output of the industry for each unit of labor, increased 2.3% last year over 1992. More production, up 3.1%, coupled with only slightly longer employee workhours, up 0.7%, accounted for the increase. However, wages for production workers in the chemical industry also rose 2.3% in 1993, exactly matching the productivity gain and leaving unit labor costs unchanged.

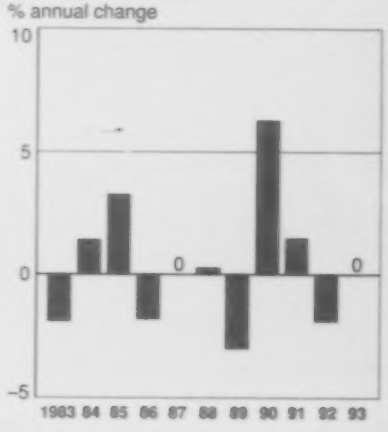
The productivity improvement for the chemical industry was just half that for all manufacturing, which rose 4.6% last year. This growth came on a 4.6% rise in output and no change in workhours. And because productivity increased much faster than the 2.6% rise in hourly production wages, unit labor costs for all manufacturing fell 2.0% for the year.

Although taken by itself, the productivity improvement for chemicals last year was not bad, it pales when compared with the annual increase in the previous year. In 1992, productivity for chemicals rose 5.5% on a much lower production increase of 2.7%. That growth came largely from reducing the work force; for the chemical industry as a whole, workhours declined 2.7% in 1992.

Chemical productivity continued to rise ...



... and unit labor costs were unchanged last year



Sources: Federal Reserve Board, Department of Labor, C&EN estimates

PRODUCTIVITY: Increased production sparked solid productivity gain for chemicals in 1993

Indexes, 1987 = 100	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
CHEMICALS & ALLIED PRODUCTS											
Production	87.5	91.4	91.4	94.6	100.0	106.0	109.2	111.8	111.3	114.3	117.8
Workhours	99.2	100.3	99.4	97.8	100.0	103.8	103.8	105.4	102.9	100.1	100.8
Productivity[a]	88.2	91.1	92.0	96.7	100.0	102.1	102.1	106.1	108.2	114.2	116.9
Hourly production wages	85.7	89.8	93.6	96.7	100.0	102.3	102.2	109.5	113.3	117.3	120.0
Unit labor costs[b]	97.2	98.6	101.7	100.0	100.0	100.2	100.2	103.2	104.7	102.7	102.7
ALL MANUFACTURING											
Production	80.9	89.3	91.6	94.3	100.0	104.7	106.4	106.1	103.9	106.8	111.7
Workhours	94.4	101.5	99.7	98.5	100.0	102.9	102.2	99.4	95.3	94.4	94.4
Productivity[a]	85.7	88.0	91.9	95.7	100.0	101.7	104.1	106.7	109.0	113.1	118.3
Hourly production wages	89.3	92.8	95.9	98.3	100.0	102.9	106.1	109.3	112.8	115.6	118.6
Unit labor costs[b]	104.2	105.4	104.3	102.7	100.0	101.2	101.2	101.3	103.5	102.2	100.2

Note: Data for 1988 and subsequent years have been revised; earlier years have not. a Productivity is output per workhour, calculated by dividing indexes for production by indexes for workhours of production employees. b Unit labor costs are labor costs per unit of output, calculated by dividing indexes for wages by indexes for output per workhour.
Sources: Federal Reserve Board, Department of Labor, C&EN estimates

Markets for chemicals continue to grow

The U.S. economy as a whole—and those parts of it in particular that are heavy users of chemicals—generally continued to grow in 1993. The U.S. gross domestic product rose 3.0% last year, after an adjustment for inflation, following a 2.7% increase the year before. As a result, consumers spent more on goods and services in 1993. Government figures reveal that constant-dollar personal consumption spending rose 3.3% in 1993, faster than the economy in general. This follows 2.5% growth in 1992.

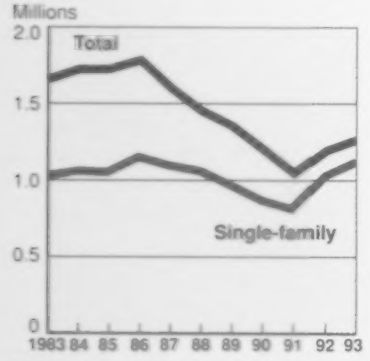
Two big end-use markets for chemicals—housing and motor vehicles—posted large and welcome increases in demand last year. The total number of housing starts was up 8% in 1993 with starts of single-family homes rising 10%, as attractive mortgage interest rates lured buyers into the market. Markets for home furnishings and home electrical appliances also rose at healthy rates in 1993, growing 6% and 16%, respectively.

Lower interest rates also helped 1993 motor vehicle sales—passenger car factory sales grew 5%, and sales of trucks and buses jumped 19%. Much of the large increase in the truck group came from small utility vehicles and pickup trucks, according to analysts. Factory sales for all motor vehicles rose 11% in 1993.

Several other of the chemical industry's key markets showed more moderate increases last year. Among them were tires, paper and paperboard, plastic products, textile mill products, and steel production.

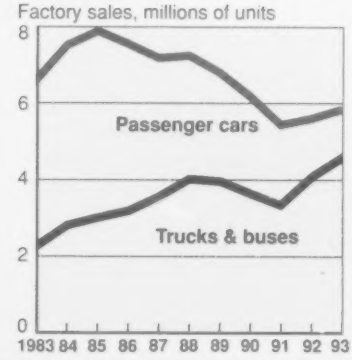
On the downside were apparel, which slipped 1%, and aluminum, down 8%. Crop production—another important chemicals market—decreased 14% in 1993 as a result of poor weather conditions throughout the country, according to the Department of Agriculture.

Housing starts



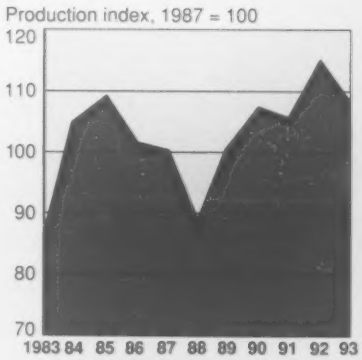
Source: Bureau of the Census

Motor vehicles



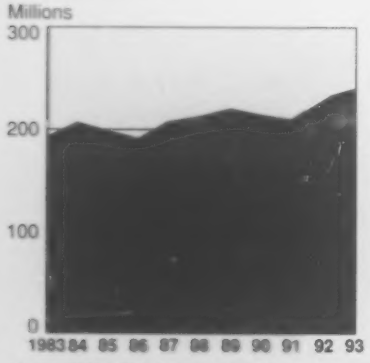
Source: Motor Vehicle Manufacturers Association

Crops



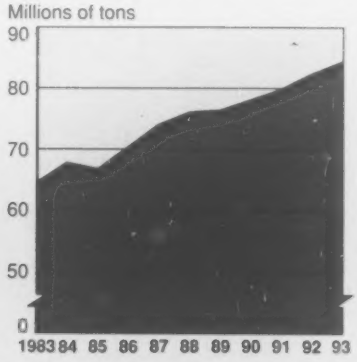
Source: Department of Agriculture

Tires and tubes



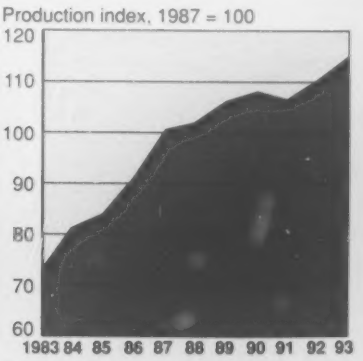
Source: Rubber Manufacturers Association

Paper and paperboard



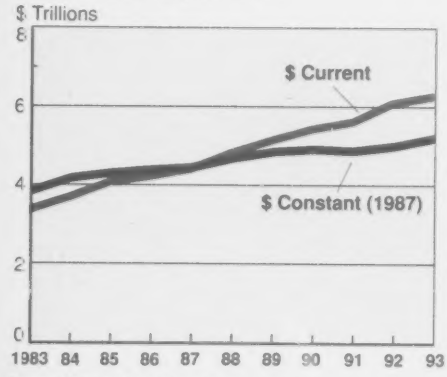
Source: American Paper Institute

Plastic products



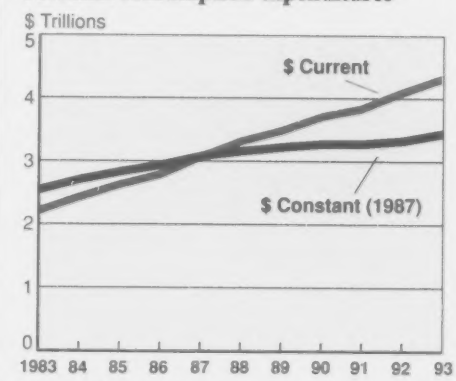
Source: Federal Reserve Board

Gross domestic product



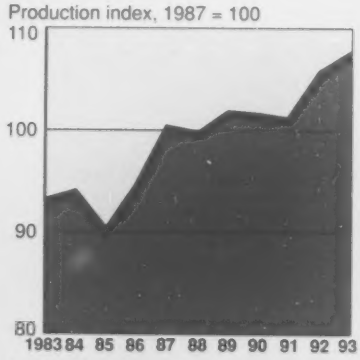
Source: Department of Commerce

Personal consumption expenditures



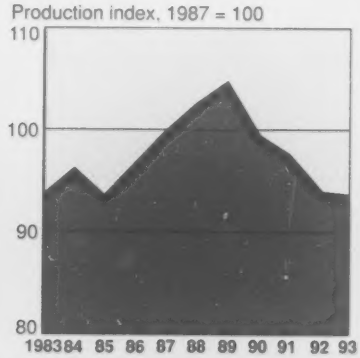
Source: Department of Commerce

Textile mill products



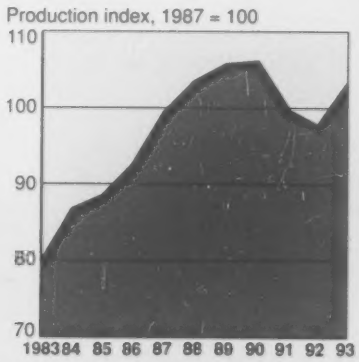
Source: Federal Reserve Board

Apparel



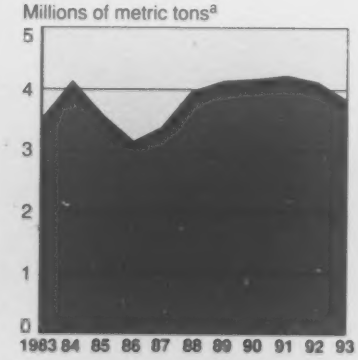
Source: Federal Reserve Board

Furniture and fixtures



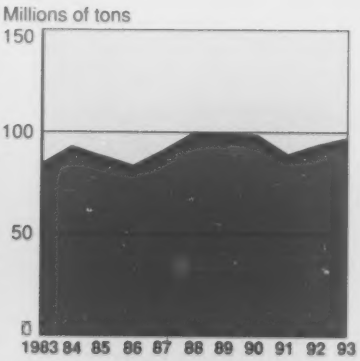
Source: Federal Reserve Board

Aluminum



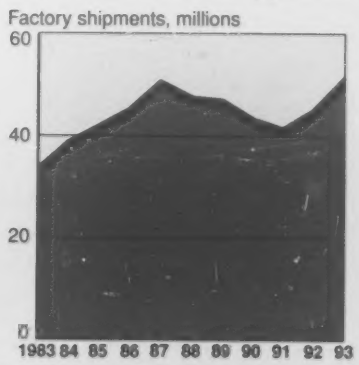
a Primary production. **Source:** Bureau of Mines

Steel



Source: American Iron & Steel Institute

Major home electrical appliances



Source: Association of Home Appliance Manufacturers

U.S. chemical exports rise slightly

Last year, U.S. chemical companies managed to boost exports 2.5% to just over $45 billion. That's not much of a gain. But considering the sad state that most of the world's economies were in during 1993, any increase at all has to be deemed quite an achievement.

It was also enough to inch the U.S. share of world chemical exports up ever so slightly, from 15.1% in 1992 to 15.2% last year. That's because the world's entire exports of chemicals rose only 2.3% to an estimated $327 billion.

Estimating world chemical exports is a tricky business at best. Exchange rates fluctuate, and different statistical sources use different rates to convert all countries' exports to dollars.

Another reason is that many countries are late in reporting their trade results. United Nations' totals for world chemical trade, for instance, are usually two years old by the time they are compiled.

This year, estimating world chemical trade is even more difficult than usual. That's because complete trade figures for the European Union (EU)—formerly the European Community (EC)—haven't been compiled for 1993. And EU member countries are among the world's largest chemical traders.

Until last year, the EC typically reported both internal (within the EC) and external (outside the EC) trade figures. Together, they provide a measure of the total chemical trade of a member country. However, when the EU completed its switch to a single market in 1993, customs controls among member countries were scrapped. As a result, the records from which internal EU trade figures were derived disappeared.

The EU itself and the European Chemical Industry Council are working to correct this statistical vacuum. At press time, however, the vacuum still existed.

So, to round out the world chemical export picture, C&EN has estimated the total chemical trade of EU member countries by taking the available external trade figures and adjusting them using recent ratios of external to internal trade figures.

U.S. TOTAL TRADE BALANCE: Deficit grew 37% last year to top $115 billion

$ Billions	1990	1991	1992	1993	% annual change 1992–93
Total exports	$394.0	$421.9	$448.2	$464.8	3.7%
Total imports	495.0	488.1	532.5	580.5	9.0
Trade balance	–101.0	–66.2	–84.3	–115.7	—

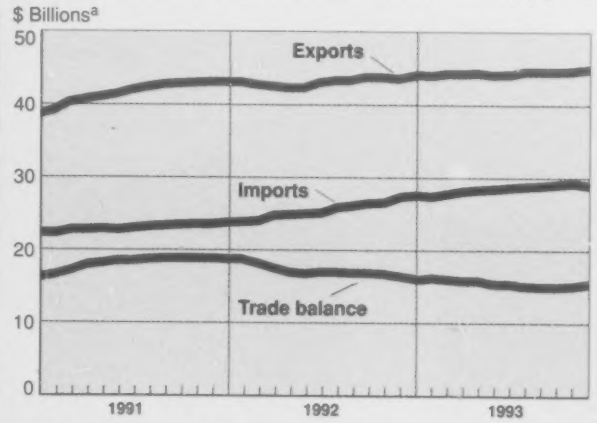
Source: Department of Commerce

U.S. CHEMICAL TRADE BALANCE: Still strongly positive, but declining

$ Millions	1990	1991	1992	1993	% annual change 1992–93
Chemical exports	$38,983	$42,967	$43,956	$45,066	2.5%
Chemical imports	22,468	24,169	27,684	29,166	5.4
Chemical trade balance	16,515	18,798	16,272	15,900	–2.3

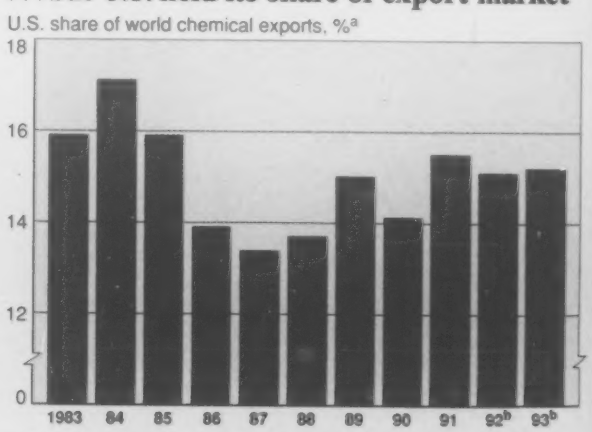
Source: Department of Commerce

U.S. chemical trade balance down in 1993 . . .



a Running 12-month totals. **Source:** Bureau of the Census

. . . but U.S. held its share of export market



a U.S. chemical exports as a percentage of total world chemical exports less U.S. chemical imports. b C&EN estimates.

U.S. CHEMICAL TRADE: Canada's share, now nearly a fifth, is fastest growing

$ Millions	1990		1991		1992		1993		% change, 1992–93	
	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports
European Union	$10,509	$ 9,728	$11,250	$10,418	$12,050	$12,067	$11,238	$12,262	–7%	2%
Canada	6,050	4,305	6,555	4,352	7,285	4,950	8,224	5,499	13	11
Latin America	5,773	1,287	6,590	1,333	7,222	1,582	7,743	1,606	7	2
Japan	4,582	2,391	5,047	2,706	4,708	3,175	4,966	3,604	6	14
Communist Asia	1,054	337	1,671	392	1,208	509	848	591	–30	16
Rest of Asia	6,566	1,267	7,172	1,445	7,054	1,589	7,384	1,665	5	5
Australia	1,247	344	1,357	421	1,432	332	1,452	303	1	–9
Middle East	629	355	673	372	766	408	761	514	–1	26
Africa	628	90	715	95	609	108	617	132	1	22
Eastern Europe	460	242	387	263	174	270	254	418	46	55
Other	1,485	2,122	1,550	2,372	1,448	2,694	1,579	2,572	9	–5
TOTAL	$38,983	$22,468	$42,967	$24,169	$43,956	$27,684	$45,066	$29,166	3%	5%

Source: Department of Commerce

WORLD CHEMICAL TRADE: Rises slightly, despite falling imports to Europe

$ Millions	1990		1991		1992		1993		% change, 1992–93	
	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports
European Union[a]	$164,987	$141,643	$167,342	$144,002	$177,789	$157,762	$180,767[b]	$141,963[b]	2%	–10%
Germany	50,597	30,854	51,317	32,753	54,278	34,951	52,061[b]	31,571[b]	–4	–10
France	28,339	24,965	28,839	24,394	31,433	26,348	30,677[b]	25,567[b]	–2	–3
U.K.	23,594	19,317	24,352	19,396	26,286	20,461	26,253[b]	20,101[b]	0	–2
Netherlands	22,478	13,254	21,541	13,091	22,211	14,451	23,952[b]	12,783[b]	8	–12
Belgium-Luxembourg	16,447	13,701	16,707	13,980	18,012	14,892	19,578[b]	12,881[b]	9	–14
Italy	10,920	19,860	11,350	20,110	12,508	20,968	13,052[b]	19,830[b]	4	–5
U.S.	38,983	22,468	42,967	24,169	43,956	27,684	45,066	29,166	3	5
Japan	15,872	16,045	17,475	17,412	19,118	17,355	20,199	17,964	6	4
Switzerland	13,776	8,035	13,607	7,685	15,456	8,405	15,788	8,389	2	0
Canada	6,600	7,753	6,685	8,143	7,025	9,044	7,645	10,543	9	17
WORLD	$ 298,469	$298,469	$300,697	$300,697	$319,200[b]	$319,200[b]	$326,600[b]	$326,600[b]	2%	2%

a Includes, in addition to the listed countries, Denmark, Greece, Ireland, Portugal, and Spain. b C&EN estimates.
Sources: United Nations, Organization for Economic Cooperation & Development, European Union, individual government agencies

U.S. TRADE, BY PRODUCTS: Fertilizer exports drop sharply but imports rise

$ Millions	1990		1991		1992		1993		% change, 1992–93	
	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports
Organic chemicals	$10,400	$ 7,392	$10,928	$ 8,157	$10,993	$ 9,366	$11,090	$ 9,316	1%	–1%
Plastics in primary form	6,428	1,974	7,537	1,930	7,178	2,247	7,372	2,724	3	21
Medicinals & pharmaceuticals	4,103	2,500	4,606	3,053	5,357	3,812	5,747	4,133	7	8
Inorganic chemicals	3,816	3,234	4,102	3,299	4,119	3,300	3,813	3,285	–7	–1
Plastics in nonprimary form	2,633	1,774	2,786	1,855	3,076	2,046	3,371	2,123	10	4
Essential oils & perfume materials	1,963	1,323	2,361	1,417	2,631	1,712	3,043	1,809	16	6
Dyeing, tanning & coloring materials	1,588	1,288	1,648	1,416	1,857	1,626	2,011	1,700	8	5
Fertilizers, manufactured	2,574	955	2,980	919	2,372	952	1,798	1,135	–24	19
Other	5,478	2,028	6,020	2,123	6,363	2,623	6,821	2,941	2	12
TOTAL	$38,983	$22,468	$42,967	$24,169	$43,956	$27,684	$45,066	$29,166	3%	5%

Source: Department of Commerce

European chemicals begin slow recovery

After a serious downturn in 1992, the European chemical industry last year started on a slow path to recovery. Sales picked up in many countries, some companies that had shown losses in 1992 began making a profit again, and declines in capital investment and R&D spending slowed or actually turned up slightly.

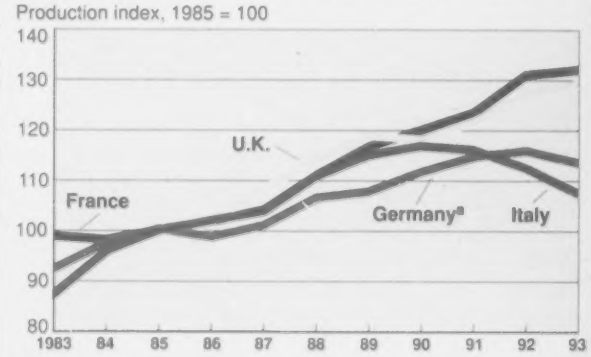
A precise picture of the chemical industry in 1993, at least in Western Europe, is difficult to obtain. Much of the region converted to a single market in 1993, the European Union, leading to changes in the way some countries collected import and export data. Additional changes occurred in Germany, which now includes the former East German states in its totals, and in the U.K., which is currently overhauling its data collection process.

Ironically, the financial recovery of the industry occurred despite a continuing slump in production of most bulk chemicals in major Western European countries. However, specialty businesses gave the industry a boost last year. That was particularly apparent for pharmaceutical companies, as the three major Swiss drugmakers—Ciba, Roche, and Sandoz—rose dramatically in the ranks of major European chemical producers in 1993.

There were some encouraging signs that the industry was repairing its profitability—or at least limiting declines—as profit margins at some companies began creeping upward. Cost-cutting measures continued, with much emphasis given to cuts in employment. According to data compiled by the European Chemical Industry Council from its member national associations, nearly 95,000 jobs were shed last year. Almost half of them were in Germany, where the chemical work force shrank by 46,100, primarily because of rationalizations and plant closures in the former East Germany. Other former East bloc countries—Poland, Hungary, the Czech Republic, and Slovakia—accounted for a net loss of 11,200 jobs, as well.

Chemical production rose slightly in much of Eastern Europe in 1993 after three years of dramatic decline. Poland's chemical output grew 10%, and several of its neighbors—including Hungary, Bulgaria, and Romania—posted more modest gains. In the former Soviet states, however, all industrial production—including chemicals—continued to plummet last year.

U.K., France posted output gains in 1993



a Former West Germany only. **Source:** European Chemical Industry Council (CEFIC)

CHEMICAL INDUSTRY TRENDS: Sales finally begin to pick up as prices rise

$ Billions (U.S.)	1989	1990	1991	1992	1993
GERMANY[a]					
Sales	$96.8	$98.5	$100.5	$103.8	$98.7
Exports	52.1	51.2	50.4	na	na
Imports	31.1	32.2	34.8	na	na
Capital spending	7.0	7.6	7.9	8.5	7.4
Production index[b]	109.4	112.4	114.8	116.0	113.5
Price index[b]	95.2	93.8	93.2	91.4	89.1
Employees (thousands)	582	592	594	655	609
FRANCE[c]					
Sales	$61.6	$61.8	$65.9	$63.9	$65.1
Exports	26.0	25.7	26.9	27.6	28.0
Imports	22.1	22.6	22.7	23.2	21.6
Capital spending	3.6	4.1	4.1	3.6	3.4
Production index[b]	118.2	120.3	122.9	130.5	132.3
Price index[b]	103.2	103.2	103.3	102.0	99.9
Employees (thousands)	264	263	264	260	255

$ Billions (U.S.)	1989	1990	1991	1992	1993
U.K.[c]					
Sales	$40.5	$42.8	$43.4	$44.9	$49.6
Exports	18.6	20.1	21.0	22.6	26.6
Imports	15.7	16.3	16.6	17.6	20.0
Capital spending	3.1	2.8	2.8	3.3	2.9
Production index[b]	119.3	118.2	121.7	126.7	130.1
Price index[b]	116.4	121.7	126.5	128.6	-134.0
Employees (thousands)	323	317	306	305	293
ITALY					
Sales	$38.5	$39.3	$39.7	$40.7	$42.6
Exports	10.0	9.9	9.8	11.0	13.7
Imports	16.0	16.4	16.7	17.9	19.3
Capital spending	2.0	2.2	2.4	2.3	2.1
Production index[b]	115.0	117.1	115.8	112.2	107.5
Price index[b]	110.7	117.1	120.4	114.2	117.1
Employees (thousands)	220	217	215	208	200

$ Billions (U.S.)	1989	1990	1991	1992	1993
BELGIUM[c,d,e]					
Sales	$26.7	$27.1	$27.5	$27.5	$27.4
Exports	20.0	20.0	20.6	21.2	na
Imports	16.5	16.8	17.4	17.6	na
Capital spending	2.0	2.6	2.7	2.2	1.5
Production index[b]	124.9	132.3	130.0	144.1	137.5
Price index[b]	102.1	98.8	98.1	97.5	96.9
Employees (thousands)	95	97	99	99	97
SPAIN[c,d]					
Sales	$30.3	$32.3	$31.4	$32.1	$23.4
Exports	4.8	5.0	5.1	5.4	4.4
Imports	8.3	8.3	9.4	10.2	9.3
Capital spending	0.7	0.8	0.8	0.7	1.0
Production index[b]	128.6	132.5	130.9	109.3	108.2
Price index[b]	108.3	112.1	112.8	99.2	100.7
Employees (thousands)[f]	240	240	225	129	125
NETHERLANDS					
Sales	$25.5	$25.8	$24.4	$23.3	$21.4
Exports	25.2	23.6	23.3	22.6	20.8
Imports	15.5	13.9	13.9	14.5	14.4
Capital spending	2.3	2.3	2.3	1.8	1.3
Production index[b]	118.0	120.0	120.0	119.0	116.0
Price index[b]	92.0	89.0	87.0	87.0	84.0
Employees (thousands)	93	93	92	89	85
SWITZERLAND[c]					
Sales	$13.9	$14.5	$15.1	$16.2	$17.3
Exports	12.0	12.4	12.9	14.4	15.1
Imports	7.2	7.2	7.2	7.7	8.0
Production index[b]	119.0	119.6	120.6	124.9	134.8
Price index[b]	97.0	97.9	97.9	98.1	96.8
Employees (thousands)	72	73	72	72	72
SWEDEN					
Sales	$6.1	$6.4	$6.1	$6.3	$7.2
Exports	3.1	3.3	3.6	3.9	5.0
Imports	3.9	4.0	3.9	3.9	4.9
Capital spending	0.5	0.5	0.5	0.5	0.5
Production index[b]	115.0	119.5	111.0	118.4	127.7
Price index[b]	116.0	118.0	122.3	120.0	126.5
Employees (thousands)	42	41	40	37	36
IRELAND[c]					
Sales	$3.8	$4.2	$4.7	$5.4	$5.8
Exports	3.4	3.4	3.9	4.7	5.1
Imports	2.2	2.3	2.5	2.5	2.6
Production index[b]	144.8	149.0	175.4	212.9	225.0
Price index[b]	96.8	92.5	91.1	92.5	99.0
Employees (thousands)	13	14	15	15	15
AUSTRIA					
Sales	$7.9	$7.8	$7.8	$7.7	$5.0
Exports	3.4	3.4	3.6	3.7	3.6
Imports	4.5	4.7	4.9	5.0	5.1
Capital spending	0.8	0.9	0.8	0.8	0.7
Production index[g]	103.8	105.4	105.2	101.3	98.2
Employees (thousands)[f]	57	57	54	33	31

$ Billions (U.S.)	1989	1990	1991	1992	1993
POLAND					
Sales	$2.3	$2.9	$2.4	$3.2	$5.0
Exports	0.7	0.7	0.6	0.9	1.1
Imports	0.4	0.5	0.5	1.6	2.6
Capital spending	0.2	0.2	0.2	0.3	0.3
Production index[h]	109.8	81.6	70.6[i]	75.4[i]	82.6[i]
Price index[b]	744.9	6,078.8	26,805.0	9,905.0	12,727.0
Employees (thousands)	158	158	148	160	164
DENMARK					
Sales	$4.0	$4.0	$4.4	$4.6	$4.5
Exports	3.1	3.1	3.3	3.7	3.7
Imports	3.5	3.5	3.6	3.7	na
Capital spending	0.4	0.3	0.4	0.3	na
Production index[b]	110.0	111.0	111.9	118.9	118.4
Price index[b]	109.0	112.0	114.1	115.9	114.9
Employees (thousands)	27	27	27	27	28
FINLAND					
Sales	$4.0	$4.4	$3.9	$3.6	na
Exports	0.6	1.1	1.1	1.3	$1.5
Imports	1.0	1.9	1.8	2.0	2.3
Capital spending	0.4	0.5	0.4	0.2	na
Production index[b]	120.2	116.8	109.9	108.5	109.2
Price index[b]	107.8	109.1	110.9	114.0	116.9
Employees (thousands)	20	19	19	19	18
NORWAY					
Sales	$3.2	$3.2	$3.9	$3.1	$3.1
Exports	1.9	2.0	2.0	1.9	1.9
Imports	1.9	2.0	2.1	2.1	2.3
Capital spending	0.2	0.2	0.2	0.2	0.2
Production index[b]	108.6	114.0	111.3	109.9	116.4
Price index[b]	122.0	120.3	122.0	117.6	118.0
Employees (thousands)	14	15	14	12	12
HUNGARY					
Sales	$2.0	$2.1	$2.1	$2.0	$2.3
Exports	1.1	0.9	1.3	0.9	0.9
Imports	1.0	1.3	1.4	1.4	1.7
Capital spending	0.2	0.2	0.2	0.1	0.1
Production index[b]	na	na	81.6	65.9	66.4
Price index[b]	na	na	181.2	208.0	221.5
Employees (thousands)	76	69	70	59	57
CZECH REPUBLIC					
Sales	—	—	—	$1.8	$1.6
Exports	—	—	—	1.1	1.2
Imports	—	—	—	1.3	1.5
Production index[h]	—	—	—	55.7	52.0
Price index[h]	—	—	—	229.7	240.3
Employees (thousands)	—	—	—	47	44
SLOVAKIA					
Sales	—	—	—	$2.9	$2.5
Exports	—	—	—	0.5	0.9
Imports	—	—	—	0.4	0.5
Capital spending	—	—	—	0.3	0.2
Production index[g]	—	—	—	78.0	74.0
Price index[g]	—	—	—	221.2	216.5
Employees (thousands)	—	—	—	49	40

Note: Monetary statistics for all years are converted from local currency to U.S. dollars on the basis of 1993 conversion rates as follows: $1.00 = 11.63 Austrian schillings, 34.56 Belgian francs, 29.12 Czech crowns, 6.48 Danish crowns, 5.72 Finnish marks, 5.66 French francs, 1.65 German marks, 90.47 Hungarian forints, 0.680 Irish pounds, 1,572 Italian lire, 1.86 Netherlands guilders, 7.09 Norwegian crowns, 18,094 Polish zlotys, 33.35 Slovakian crowns, 127.2 Spanish pesetas, 7.79 Swedish crowns, 1.48 Swiss francs, and 0.670 British pounds. **a** Production and price indexes for all years are for former West Germany only; other data for 1992 and 1993 are for all of Germany; for earlier years all data are for the former West Germany only. **b** 1985 = 100. **c** Excludes fibers. **d** Includes rubber and plastics processing. **e** Includes Luxembourg for exports and imports. **f** 1991 and earlier years include plastics and rubber processing employees. **g** 1990 = 100. **h** 1989 = 100. **i** C&EN estimates. **na** = not available. **Source:** European Chemical Industry Council (CEFIC)

MAN-MADE FIBERS: Production declined in both Western and Eastern Europe in 1993

Millions of lb	1989		1990		1991		1992		1993		% change, 1992–93	
	Non-cellulosics	Cellulosics	Non-cellulosics	Cellulosics	Non-cellulosics	Cellulosics	Non-cellulosics	Cellulosics	Non-cellulosics	Cellulosics	Non-cellulosics	Cellulosics
Germany	1,841	394	1,848	396	1,779	382	1,804	360	1,797	392	0%	9%
Italy	1,412	77	1,450	79	1,482	79	1,528	71	1,378	68	–10	–4
Benelux countries	521	119	568	117	606	115	598	110	593	99	–1	–10
Spain	592	88	585	79	558	66	595	49	578	20	–3	59
U.K.	493	255	506	266	514	218	529	172	512	146	–3	–15
France	392	4	343	0	260	0	269	0	260	0	–3	—
Ireland	207	0	205	0	210	0	240	0	240	0	0	—
Switzerland	264	0	260	0	238	0	247	0	212	0	–14	—
Poland	371	152	250	79	175	57	195	49	211	51	8	4
Portugal	141	2	141	1	141	0	163	0	148	0	–9	—
Bulgaria	200	10	164	9	151	9	106	6	na	na	—	—
Romania	374	227	308	156	233	84	189	57	85	14	–55	–75
Austria	77	301	84	297	84	262	90	282	82	289	–9	3
Hungary	70	9	59	9	61	6	55	0	51	0	–7	—
Finland	7	143	11	141	24	104	24	124	24	126	0	2

na = not available. **Source:** International Rayon & Synthetic Fibers Committee

PRODUCTION: Downturns for many chemicals in France and Italy

Millions of lb	1990	1991	1992	1993	% change 1992–93
FRANCE					
Sulfuric acid	8,306	7,970	6,642	5,061	–24%
Hydrochloric acid	1,488	1,441	1,327	1,260	–5
Chlorine	2,956	2,790	3,091	3,073	–1
Sodium hydroxide	3,143	2,933	3,250	3,240	0
Carbon black	556	494	510	450	–12
Ammonia	3,493	3,526	3,097	3,263	5
Benzene	1,434	1,542	1,618	1,604	–1
Toluene	63	57	70	113	64
Ethylene	4,948	5,328	5,829	5,600	–4
Propylene	3,157	3,546	3,971	3,667	–8
Butadiene	619	623	731	706	–3
Formaldehyde	220	95	90	92	2
Polyethylene	2,461	2,643	2,954	2,930	–1
Polypropylene	1,715	1,790	1,975	2,140	8
Polystyrene	1,193	1,164	1,119	1,060	–5
Polyvinyl chloride	2,265	2,310	2,416	2,587	7
Synthetic rubber	1,151	1,036	1,098	1,070	–3
Nitrogen fertilizers	4,655	4,026	3,812	3,891	2
Phosphate fertilizers[a]	626	554	607	265[b]	–56
GERMANY[c]					
Sulfuric acid	7,370	6,800	6,974	6,691	—
Hydrochloric acid	1,982	1,851	1,857	1,819	—
Nitric acid	3,936	2,967	2,880	4,390	—
Chlorine	7,175	6,687	5,934	6,011	—
Sodium hydroxide	7,129	6,803	6,500	6,568	—
Sodium carbonate	3,166	3,029	2,760	3,490	—
Sodium sulfate	368	306	231	239	—
Carbon black	870	837	826	736	—
Ammonia	3,686	3,418	3,500	4,621	—
Benzene	3,287	3,396	3,500	3,341	—
Toluene	1,184	1,314	1,278	988	—
Xylenes	1,276	1,200	1,218	1,235	—
Aniline	294	298	315	251	—
Ethylene	6,773	6,746	7,480	8,591	—
Propylene	4,028	4,053	4,500	5,366	—
Butadiene	1,714	1,475	1,390	1,939	—
Ethylene oxide	1,386	1,310	1,390	1,371	—
Ethylene glycol	464	443	500	509	—
Propylene oxide	1,302	1,360	1,226	1,327	—
Propylene glycol	394	395	385	424	—
n-Butanol	781	767	745	696	—
Acetaldehyde	771	744	721	766	—
Acetic acid	713	707	728	749	—
Ethanol	234	239	200	342	—
Methanol	1,656	1,580	1,700	2,645	—
Formaldehyde	1,500	1,455	1,514	1,411	—
Phthalic anhydride	507	438	400	460	—
Polyethylene	3,254	3,004	3,200	3,573	—
Polyvinyl chloride	2,913	2,593	2,516	1,385	—
Polypropylene	1,121	1,170	1,300	2,661	—
Synthetic rubber	1,154	1,123	1,080	1,284	—
Nitrogen fertilizers[d]	1,816	1,404	1,400	na	—
Phosphate fertilizers[a]	165	151	106	na	—
ITALY					
Sulfuric acid	7,190	6,523	6,102	5,067	–17%
Nitric acid	2,286	2,173	2,065	1,595	–23
Hydrochloric acid	1,630	1,279	1,265	1,217	–4
Phosphoric acid	497	371	192	81[e]	–59
Chlorine	2,300	1,903	1,946	1,901	–2
Sodium hydroxide	2,427	2,300	2,123	2,055	–3
Sodium perborate	271	269	286	277	–3
Carbon black	405	408	402	377	–6
Ammonia	3,207	3,063	2,988	1,948	–35
Benzene	1,351	1,354	1,137	1,320	16
Toluene	423	410	285	431	51
Xylenes	841	875	710	325	–54
Formaldehyde	251	228	191	131	–31
Acetic acid	21	21	19	18	–5
Polyethylene	2,053	2,089	2,039	2,091	2
Polystyrene	778	684	619	602	–3
Polyvinyl chloride	1,362	1,367	1,358	1,346	–1
Nitrogen fertilizers[d]	5,261	5,062	5,802	5,017	–14
U.K.[f]					
Sulfuric acid[g]	2,847	2,478	2,170	na	—
Hydrochloric acid[g]	358	338	328	na	—
Chlorine	2,073	1,938	1,890	na	—
Sodium hydroxide[g]	2,126	2,471	1,993	na	—
Benzene	1,544	2,009	1,717	na	—
Ethylene	3,296	3,991	4,263	na	—
Propylene	1,653	1,748	1,835	na	—
Butadiene	436	436	501	na	—
Acetone	283	278	281	na	—
Formaldehyde	94	131	131	na	—
Polyethylene[h]	740	830	693	na	—
Polypropylene	653	696	721	913	27%
Polyvinyl chloride	768	712	647	539	–17
Synthetic rubber	605	554	558	485	–13

a As P_2O_5. **b** Data for 1993 are C&EN estimates based on nine months' reporting. **c** Data for 1990–92 are for the former West Germany only. 1993 data are for all Germany and are not comparable to those from earlier years. **d** As N. **e** C&EN estimates based on six months' reporting. **f** Changes in collection of U.K. data have delayed release of most 1993 figures. **g** Manufacturers' sales. **h** Excludes linear low-density polyethylene. **na** = not available. **Sources:** British Plastics Federation, British Rubber Institute, government agencies for each country

COMPANY RESULTS: About half increased income in 1993, nearly all cut staff

$ Millions	Net sales	Net income	Profit margin[a]	Capital spending	R&D spending	Employees (thousands)
Hoechst (Germany)						
1993	$27,907.3	$458.2	1.6%	$2,180.0	$1,841.8	172.5
1992	27,800.0	716.4	2.6	2,290.3	1,760.0	177.7
1991	28,597.6	1,357.0	2.9	2,162.4	1,738.8	179.3
1990	27,189.1	1,027.9	3.8	2,059.9	1,628.4	172.9
BASF (Germany)						
1993	$26,135.2	$520.0	2.0%	$2,508.5	$1,172.1	112.0
1992	26,983.3	372.5	1.4	2,515.8	1,241.5	123.2
1991	28,258.3	629.9	2.2	2,909.1	1,250.2	129.4
1990	28,256.6	671.1	2.4	2,701.9	1,253.7	134.6
Bayer (Germany)						
1993	$24,852.7	$831.5	3.3%	$1,912.7	$1,913.3	151.9
1992	24,966.7	918.8	3.7	1,732.7	1,876.4	156.4
1991	25,697.6	1,105.5	4.3	1,863.0	1,822.4	164.2
1990	25,238.2	1,140.0	4.5	2,233.9	1,659.4	171.0
ICI (U.K.)						
1993[b]	$15,964.0	$381.4[c]	2.4%	$698.2	$549.5	87.1
1992	18,109.6	(456.5)[d,e]	—	1,216.2	1,129.1	117.5
1991	18,750.8	813.8	4.3	1,331.8	944.4	128.6
1990	19,378.4	867.9[f]	4.8	1,521.0	1,019.5	132.1
Ciba (Switzerland)						
1993	$15,302.0	$1,202.0	7.9%	$1,175.0	$1,487.8	87.5
1992	15,002.7	1,027.0	6.8	1,254.7	1,567.8	90.6
1991	14,261.5	864.9	6.1	1,322.3	1,476.4	91.7
1990	13,312.8	698.0	5.2	1,390.5	1,385.8	94.1
Rhône-Poulenc (France)						
1993	$14,233.9	$325.8	2.3%	$1,097.2	$1,131.6	81.7
1992	14,436.2	385.9	2.7	1,019.8	1,053.4	83.3
1991	14,808.7	354.1	2.4	1,366.7	1,013.4	87.0
1990	13,924.1	343.2	2.5	1,325.0	936.4	91.6
Sandoz (Switzerland)						
1993	$10,202.7	$1,148.6	11.3%	$662.4	$1,182.6	52.6
1992	9,740.5	1,010.1	10.3	805.4	1,010.8	53.4
1991	9,083.8	752.7	8.3	856.8	897.3	53.4
1990	8,356.1	653.4	7.8	858.1	816.2	52.6
Roche Group (Switzerland)						
1993	$9,672.3	$1,674.3	17.3%	$950.7	$1,461.5	56.1
1992	8,752.0	1,294.6	14.8	873.6	1,350.0	56.3
1991	7,737.2	1,001.4	12.9	769.6	1,166.9	55.1
1990	6,533.8	640.5	9.8	612.8	975.7	52.7
Degussa (Germany)						
1993[g]	$9,030.9	$73.3	0.8%	$301.8	$284.2	32.1
1992[g]	7,766.7	73.3	0.9	366.7	292.1	33.4
1991[g]	8,090.9	60.0	0.7	474.5	293.3	34.5
1990[g]	8,439.4	89.0	1.1	412.7	277.6	35.0
Akzo Nobel (Netherlands)						
1993[h]	$8,875.8	$375.3[i]	4.2%	$629.0	$499.5	60.7
1992	9,059.1	393.0[j]	4.3	501.6	499.5	62.5
1991	9,059.8	365.1[k]	4.0	541.4	481.7	65.2
1990	9,272.0	384.9[l]	4.2	607.0	479.0	69.8
Norsk Hydro (Norway)						
1993	$8,794.0	$422.6	4.8%	$1,047.2	$98.7	32.5
1992	8,189.3	(27.5)[d]	—	1,076.6	100.1	30.1
1991	8,663.3	(70.2)[d]	—	1,073.6	124.3	35.0
1990	8,599.7	409.2	4.8	987.0	102.0	33.0

$ Millions	Net sales	Net income	Profit margin[a]	Capital spending	R&D spending	Employees (thousands)
Solvay (Belgium)						
1993	$7,056.2	$(114.5)[d,m]	—	$554.9	$343.8	43.2
1992	7,354.6	303.8[n]	4.1%	1,286.1	352.3	45.4
1991	7,364.2	306.7[o]	4.2	979.8	371.8	45.6
1990	7,376.9	514.5[p]	7.0	1,054.9	371.3	45.7
EniChem (Italy)						
1993	$6,761.8	$(1,695.0)[d]	—	$323.0	$137.0	30.6
1992	7,087.0	(991.1)[d]	—	747.8	195.0	33.0
1991	8,528.6	(471.4)[d]	—	857.7	251.6	37.0
1990	9,567.3	(43.1)[d]	—	1,165.2	204.6	49.0
Air Liquide (France)						
1993	$5,366.6	$393.1	7.3%	$684.8	$82.3	28.0
1992	5,175.6	392.4	7.6	604.1	81.8	28.0
1991	5,621.7	390.4	6.9	726.3	133.7	28.0
1990	5,108.6	348.3	6.8	700.6	129.6	na
BOC International (U.K.)						
1993[q]	$4,858.1	$306.2	6.3%	$617.0	$128.1	40.3
1992[q]	4,100.9	292.0[q]	7.1	592.0	121.9	37.1
1991[q]	4,081.8	290.5	7.1	640.8	95.6	39.7
1990[q]	3,969.8	358.9	9.0	462.5	93.3	40.0
DSM (Netherlands)						
1993	$4,322.6	$(32.3)[d,r]	—	$399.5	$209.7	20.6
1992	4,788.7	120.4	2.5%	573.1	228.5	22.4
1991	5,025.3	277.4	5.5	944.1	228.5	24.8
1990	5,464.5	436.0[s]	8.0	704.3	228.5	24.9
Schering Group (Germany)						
1993	$3,250.3	$153.9	4.7%	$280.6	$588.5	23.3
1992	3,798.4	159.4	4.2	417.6	599.4	26.0
1991	3,854.2	214.7[t]	5.6	295.8	584.2	26.3
1990	3,589.9	212.5	5.9	310.5	566.5	26.0
Courtaulds (U.K.)						
1993[u]	$2,995.9	$155.9[v]	5.2%	$198.9	$58.9	19.0
1992[u]	3,114.4	227.6	7.3	159.2	58.0	21.0
1991[u]	2,916.8	215.2	7.4	190.7	60.1	22.7
1990[u]	2,870.3	217.0[w]	7.6	na	60.1	23.6
Kemira (Finland)						
1993	$2,073.2	$48.5	2.3%	$148.9	na	11.4
1992	1,960.6	(120.8)[d]	—	160.2	na	12.6
1991	1,899.8	(100.0)[d,x]	—	206.7	na	14.3
1990	1,993.3	29.2[y]	1.5	198.9	na	15.3
Novo Nordisk (Denmark)						
1993	$1,877.0	$220.1	11.7%	$369.1	$269.3	11.6
1992	1,651.1	196.9	11.9	302.0	234.9	10.7
1991	1,444.6	143.2	9.9	208.0	207.9	9.6
1990	1,244.8	120.1	9.6	180.9	184.4	8.7
Laporte (U.K.)						
1993	$1,316.8	$116.5	8.8%	$73.3	$9.8	7.1
1992	783.5	96.1	12.3	111.3	9.2	5.4
1991	924.2	104.5	11.3	81.1	6.6	5.5
1990	974.5	107.5	11.0	61.6	6.3	5.6
Dyno (Norway)						
1993	$1,160.0	$21.3	1.8%	$120.7	$15.2	7.3
1992	1,055.0	7.2	0.7	109.2	14.5	7.5
1991	1,089.4	(8.1)[d]	—	103.6	16.5	7.0
1990	1,000.7	17.5	1.7	121.4	16.8	7.3

Note: All corporate consolidated sales exclude sales of companies owned less than 50%. Monetary statistics for all years are converted from local currency to U.S. dollars on the basis of 1993 conversion factors as follows: $1.00 U.S. = 34.60 Belgian francs, 6.48 Danish crowns, 5.71 Finnish marks, 5.66 French francs, 1.65 German marks, 1,574 Italian lire, 1.86 Netherlands guilders, 7.09 Norwegian crowns, 1.48 Swiss francs, and 0.666 British pounds. a Net income as a percentage of sales. b Data for 1993 figures exclude results of Zeneca, spun off on June 1, 1993. c Excludes nonrecurring loss of $174 million. d Net loss. e Excludes nonrecurring loss of $399 million. f Excludes nonrecurring gain of $138 million. g Fiscal year ends Sept. 30. h Data for 1993 figures exclude results of Nobel Industries, acquired Nov. 8, 1993. i Excludes nonrecurring loss of $77 million. j Excludes nonrecurring loss of $36 million. k Excludes nonrecurring loss of $60 million. l Excludes nonrecurring loss of $34 million. m Excludes nonrecurring loss of $85 million. n Excludes nonrecurring gain of $53 million. o Excludes nonrecurring gain of $52 million. p Excludes nonrecurring loss of $55 million. q Excludes nonrecurring gain of $155 million. r Excludes nonrecurring loss of $31 million. s Excludes nonrecurring gain of $26 million. t Excludes nonrecurring loss of $48 million. u Fiscal year ends March 31. v Excludes nonrecurring loss of $33 million. w Excludes nonrecurring loss of $104 million. x Excludes nonrecurring loss of $16 million. y Excludes nonrecurring loss of $32 million.

EAST EUROPEAN PRODUCTION: Chemicals are recovering except in former Soviet states

Millions of lb	1990	1991	1992	1993	% change 1992–93
BELARUS					
Production indexes[a]					
All industry	101.6	100.1	91.1	78.3[b]	
Chemicals	99.4	94.7	82.4	65.9[b]	
Sulfuric acid	2,589	2,196	1,335	867	–36%
Mineral fertilizers[c]	13,191	11,350	8,952	5,500	–39
Nitrogen	1,639	1,575	1,461	na	—
Phosphate	563	466	222	na	—
Potassium	10,987	9,308	7,269	na	—
Plastics	1,652	1,577	1,384	1,045[b]	–24
Soaps & detergents	86	68	64	55[b]	–14
BULGARIA					
Production indexes[a]					
All industry	87.4	63.1	49.2	44.6[b]	
Chemicals	74.3	52.2	43.1	44.0[b]	
Sulfuric acid	1,045	783	759	682[b]	–10%
Mineral fertilizers[c]	1,296	950	715	649[b]	–9
Nitrogen	1,195	869	na	na	—
Phosphate	103	81	na	na	—
Ammonia[d]	2,880	2,405	1,364	880[b]	–36
Plastics	546	312	275	330[b]	20
Ethylene	385	246	220	209	–5
Sodium hydroxide[e]	233	169	150	134	–10
Sodium carbonate[f]	2,301	1,965	na	na	—
Pesticides[g]	22	15	na	na	—
HUNGARY					
Production indexes[a]					
All industry	95.5	75.0	67.6	69.2[b]	
Chemicals	94.6	77.1	66.6	67.1[b]	
Sulfuric acid	537	284	202	161	–21%
Mineral fertilizers[c]	1,648	810	444	506	14
Nitrogen	1,034	550	405	486	20
Phosphate	123	29	2	11	500
Potassium	491	231	37	9	–76
Ammonia[d]	1,191	703	672	617	–8
Plastics	1,353	1,445	1,522	1,527	0
Polyethylene	486	546	605	570	6
Polypropylene	341	330	326	299	8
Polyvinyl chloride	409	389	389	403	3
Ethylene	515	572	618	607	–2
Propylene	367	387	431	431	0
Sodium hydroxide[e]	425	374	306	266	–13
Synthetic detergents	268	196	172	167	–3
Pesticides[g]	53	33	29	33	15
POLAND					
Production indexes[a]					
All industry	75.8	66.8	69.6	74.7[b]	
Chemicals	75.0	64.9	69.3	75.9[b]	
Sulfuric acid	3,786	2,394	na	na	—
Mineral fertilizers[c]	3,892	3,069	3,282	3,311	1%
Nitrogen	2,864	2,519	2,567	2,693	5
Phosphate	1,027	550	724	618	–15
Ammonia[d]	4,325	3,375	3,307	3,527	7
Plastics	1,373	1,305	1,430	1,467	3
Polyethylene	345	330	359	361	1
Polypropylene	189	178	211	240	14
Polystyrene	31	40	53	70	33%
Polyvinyl chloride	447	429	484	464	–4
Ethylene	678	596	na	na	—
Detergents	532	493	427	477	12
Sodium hydroxide[e]	889	713	719	651	–9
Methanol	341	224	na	na	—
Synthetic rubber	227	176	196	165	–6
Pesticides[g]	44	37	48	48	0
ROMANIA					
Production indexes[a]					
All industry	82.2	63.5	49.4	50.1[b]	
Chemicals	67.5	50.3	43.2	44.9[b]	
Sulfuric acid	2,473	1,639	1,261	1,164	–8%
Mineral fertilizers[c]	3,837	2,402	3,082	2,882	–6
Nitrogen	2,695	1,672	na	na	—
Phosphate	935	583	na	na	—
Ammonia[d]	4,802	3,031	3,197	3,307	3
Plastics	1,038	768	587	561	–4
Ethylene	535	356	279	268	–4
Sodium hydroxide[e]	1,214	1,023	825	717	–13
Sodium carbonate[f]	1,406	1,052	1,005	834	–17
Synthetic rubber	224	121	79	66	–17
Synthetic detergents	189	147	106	110	4
Pesticides[g]	24	40	37	42	12
RUSSIA					
Production indexes[a]					
All industry	100.0	92.1	75.5	63.3	
Chemicals	97.4	91.3	72.1	57.0	
Sulfuric acid	28,087	25,520	21,437	18,040	–16%
Mineral fertilizers[c]	35,154	33,092	26,686	18,920	–29
Nitrogen	15,089	14,696	12,793	8,954	–30
Phosphate	10,875	9,405	6,633	4,620	–30
Potassium	8,466	8,989	7,634	5,346	–30
Plastics	7,168	6,519	5,830	4,862	–17
Synthetic detergents	1,927	1,529	1,210	na	—
Sodium hydroxide[e]	4,968	4,492	4,180	3,124	–25
Sodium carbonate[f]	7,128	6,706	5,940	4,400	–26
Synthetic rubber	na	4,426	3,564	na	—
Pesticides[g]	244	191	141	na	—
UKRAINE					
Production indexes[a]					
All industry	99.9	95.0	89.3	75.0[b]	
Chemicals	99.0	92.1	81.0	60.8[b]	
Sulfuric acid	11,024	9,209	6,576	4,400	–33%
Mineral fertilizers[c]	10,560	9,240	7,260	5,500	–24
Nitrogen	6,600	6,160	5,588	4,235	–24
Phosphate	3,520	2,860	1,408	1,045	–26
Potassium	220	220	264	220	–17
Ammonia[d]	10,811	10,212	10,459	na	—
Plastics	1,817	1,841	1,221	649	–47
Synthetic detergents	662	568	na	na	—
Sodium hydroxide[e]	977	975	884	660	–25
Sodium carbonate[f]	2,462	2,341	2,400	1,729	–28
Pesticides[g]	110	86	48	na	—

a Production indexes developed by C&EN based on information from national statistical offices, 1989 = 100. b Estimated. c Nutrient content basis, as N, P_2O_5, or K_2O. d Nitrogen content. e 96% NaOH. f 96% Na_2CO_3. g On basis of active substance. na = not available.
Sources: PlanEcon Inc., U.S. Department of Agriculture, national central statistical offices

Foreign Chemical Industries–CANADA

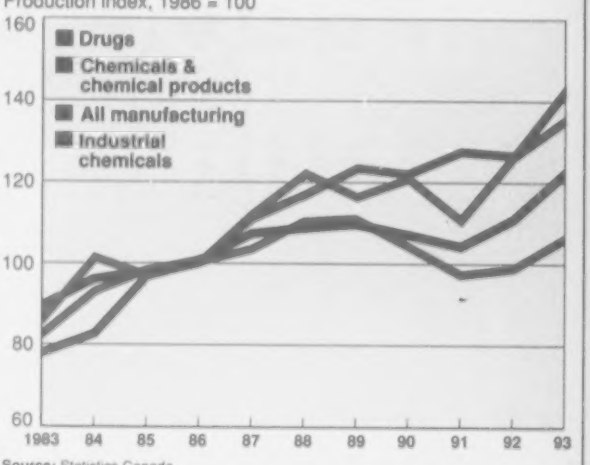
Canadian chemical makers finally put an end to their misfortunes last year. After several years of declining sales and profits, most—though not all—Canadian chemical companies were able to chalk up gains in both sales and profits in 1993. Keys to the improvement were a stronger North American economy and cost-cutting measures undertaken by many chemical companies.

Overall, chemical sales were up 7% and operating profit rose a healthy 22% last year, according to the Canadian Chemical Producers' Association. However, domestic chemical sales advanced only 4%, leaving exports to claim most of the credit for the chemical industry's improved performance. Despite a sluggish global economy that made marketing a tough task, Canadian chemical exports rose 9% to almost $7 billion (in U.S. dollars). Exports, in fact, now account for almost half of Canada's total chemical sales.

But Canada's success at exporting chemicals last year was limited entirely to the U.S., which climbed out of recession much earlier than other major countries throughout the world. Exports to the U.S. rose a hefty 15% to $5.5 billion. That amounts to a lopsided 79% of Canada's chemical exports, compared with only 69% as recently as 1991. Exports to non-U.S. markets were down about 9% last year.

Polyvinyl chloride (PVC) is an excellent example of how important exports are to the Canadian chemical industry. PVC output rose almost 9% last year because exports jumped an astounding 70%. There's little doubt that exports will have to shoulder most of the growth that Canadian chemical producers hope to achieve this year.

All types of chemical production rising



Source: Statistics Canada

COMPANY RESULTS: Sales keep growing

$ Millions (U.S.)	Sales	Net income[a]	Profit margin[b]	Capital expenditures	Employees (thousands)
Celanese Canada					
1993	$376.8	$46.9	12.4%	$16.8	1.6
1992	346.3	28.3	8.2	11.7	1.5
1991	325.0	26.3	8.1	19.2	1.7
1990	254.2	31.9	12.5	18.0	1.8
DuPont Canada					
1993	$1,212.5	$50.7	4.2%	$70.7	4.0
1992	1,093.9	63.2	5.8	83.7	4.1
1991	1,023.4	43.4	4.2	109.7	4.2
1990	1,089.9	48.2	4.4	139.3	4.3
Esso Chemical Canada[c]					
1993	$777.6	$27.0	3.5%	$19.3	1.4
1992	710.4	10.8	1.5	25.5	1.4
1991	670.3	1.5	0.2	20.1	1.4
1990	706.6	18.5	2.6	32.4	1.4
Novacor Chemicals[d]					
1993	$1,782.2	$61.0	3.4%	$202.3	2.9
1992	1,660.2	100.4	6.0	61.0	3.0
1991	1,739.8	22.4	1.3	85.7	3.0
1990	2,545.9	288.0	11.3	166.8	3.3

Note: Monetary statistics for all years are converted from Canadian dollars to U.S. dollars on the basis of the 1993 average exchange rate of $1.00 U.S. = $1.295 Canadian. a Excludes extraordinary gains and losses. b Net income as a percentage of sales. c Now the chemical division of Imperial Oil Ltd. d Includes operating income only.

PRODUCTION: More gainers than losers

Thousands of metric tons	1990	1991	1992	1993	% change 1992–93
INORGANIC CHEMICALS					
Aluminum sulfate	204	192	170	217	28%
Ammonia	3,715	3,669	3,770	4,181	11
Ammonium nitrate	1,031	963	1,064	1,025	–4
Carbon black	178	157	161	166	3
Chlorine	1,542	1,402	1,364	1,170	–14
Hydrochloric acid	187	193	168	134	–20
Hydrogen peroxide	na	83	119	128	8
Nitric acid	965	912	960	917	–5
Sodium chlorate	659	695	728	830	14
Sodium hydroxide	1,650	1,498	1,428	1,225	–14
Sulfuric acid	3,311	2,953	3,225	3,683	14
ORGANICS					
Benzene	762	712	686	685	0
Butadiene	192	na	181	174	–4
Ethylene	2,434	2,425	2,521	2,536	1
Formaldehyde	106	114	133	154	16
Methanol	1,884	2,223	2,154	2,253	5
Propylene	765	717	753	766	2
Toluene	425	364	372	337	–9
Urea	2,490	2,397	2,550	3,090	21
Xylenes	514	391	339	311	–8
PLASTICS					
Polyesters, unsaturated	36	33	40	45	12
Polyethylene, high density	364	458	648	652	1
Polyethylene, low density	1,167	1,109	1,041	1,090	5
Polystyrene[a]	215	167	167	158	–5
Polyvinyl chloride	na	287	385	419	9

a Includes acrylonitrile-butadiene-styrene resins. na = not available. Source: Statistics Canada

SHIPMENTS: Most chemicals perk up as all manufacturing posts gains

$ Millions (U.S.)	1988	1989	1990	1991	1992	1993	% change 1992–93
All manufacturing	$288,549	$296,968	$294,061	$276,592	$280,482	$307,440	10%
Chemicals & chemical products	21,918	22,006	22,331	21,638	21,963	23,007	5
Industrial chemicals, inorganic	2,399	2,433	2,569	2,378	2,419	2,541	5
Industrial chemicals, organic	5,993	5,407	5,169	4,663	4,612	4,570	–1
Plastics & synthetic resins	2,503	2,563	2,819	2,586	2,631	2,789	6
Medicinals & pharmaceuticals	3,111	3,340	3,489	3,770	4,114	4,336	5
Adhesives	207	218	192	180	190	206	8
Paints & varnishes	1,501	1,538	1,618	1,562	1,378	1,429	4
Soaps & cleansers	1,525	1,643	1,518	1,667	1,814	1,843	2
Toilet preparations	1,062	1,126	983	1,048	1,194	1,237	4
Printing ink	256	251	263	238	260	286	10
Synthetic fibers	974	1,023	938	898	960	932	–3
Plastic products	5,416	5,597	5,703	5,341	5,767	6,102	6

Note: Monetary statistics for all years are converted from Canadian dollars to U.S. dollars on the basis of the 1993 average exchange rate of $1.00 U.S. = $1.295 Canadian.
Source: Statistics Canada

CHEMICAL EXPORTS: U.S. share grows

$ Millions (U.S.)	1990	1991	1992	1993
Chemical elements	$ 180	$ 152	$ 154	$ 166
Other inorganic chemicals	1,052	1,026	1,017	1,056
Organic chemicals	1,751	1,528	1,330	1,415
Fertilizers & fertilizer materials	1,432	1,344	1,221	1,261
Synthetic rubber & plastics materials	1,299	1,342	1,378	1,560
Plastics, basic shapes & forms	477	531	594	697
Other chemical products	522	589	709	815
TOTAL	**$6,712**	**$6,512**	**$6,403**	**$6,969**
Exports to U.S.	**$4,631**	**$4,465**	**$4,777**	**$5,487**
U.S. share	**69%**	**69%**	**75%**	**79%**

Note: Converted from Canadian dollars at the following exchange rates: 1990: $1.00 U.S. = $1.160 Canadian; 1991: $1.00 U.S. = $1.156 Canadian; 1992: $1.00 U.S. = $1.271 Canadian; 1993: $1.00 U.S. = $1.295 Canadian. **Source:** Statistics Canada

CHEMICAL IMPORTS: Up for all classes

$ Millions (U.S.)	1990	1991	1992	1993
Inorganic chemicals	$1,128	$1,126	$1,048	$1,192
Organic chemicals	1,788	1,724	1,732	2,028
Fertilizers & fertilizer materials	190	189	182	219
Synthetic & reclaimed rubber	242	221	234	264
Plastic materials	1,311	1,352	1,445	1,746
Plastic film & sheet	436	456	455	519
Other plastic shapes & forms	422	399	426	479
Dyes, except dyeing intermediates	94	88	87	98
Pigments, lakes & toners	115	126	154	202
Paints & related products	252	273	292	360
Other chemical products	1,155	1,211	1,249	1,457
TOTAL	**$7,132**	**$7,166**	**$7,304**	**$8,562**
Imports from U.S.	**$5,366**	**$5,491**	**$5,571**	**$6,571**
U.S. share	**75%**	**77%**	**76%**	**77%**

Note: Converted from Canadian dollars at the following exchange rates: 1990: $1.00 U.S. = $1.160 Canadian; 1991: $1.00 U.S. = $1.156 Canadian; 1992: $1.00 U.S. = $1.271 Canadian; 1993: $1.00 U.S. = $1.295 Canadian. **Source:** Statistics Canada

TRADE BALANCE: Huge jump in surplus . . .

$ Billions (U.S.)	1990	1991	1992	1993	% change 1992–93
Total exports	$122.2	$119.7	$121.0	$136.5	13%
Total imports	117.4	117.0	116.4	130.8	12
Trade balance	4.8	2.7	4.6	5.7	24

. . . and a much higher chemical trade deficit

$ Millions (U.S.)	1990	1991	1992	1993	% change 1992–93
Chemical exports	$6,712	$6,512	$6,403	$6,969	9%
Chemical imports	7,132	7,166	7,304	8,562	17
Chemical trade balance	–420	–654	–901	–1,593	—

Note: Converted from Canadian dollars at the following exchange rates: 1990: $1.00 U.S. = $1.160 Canadian; 1991: $1.00 U.S. = $1.156 Canadian; 1992: $1.00 U.S. = $1.271 Canadian; 1993: $1.00 U.S. = $1.295 Canadian. **Source:** Statistics Canada

PRICES: Rising for most chemicals

Price index, 1986 = 100	1990	1991	1992	1993	% change 1992–93
All commodities	109.7	108.7	109.1	112.7	3%
Chemicals & chemical products	113.8	115.2	113.6	116.4	3
Inorganic industrial chemicals	103.8	103.9	102.7	105.4	3
Sulfuric acid	111.1	110.0	99.5	95.4	–4
Chlorine	93.0	84.9	82.4	86.3	5
Ammonia	78.4	77.2	77.9	85.4	10
Organic industrial chemicals	118.2	120.8	111.7	119.7	7
Benzene-toluene-xylene	127.7	111.4	104.9	97.6	–7
Olefins	133.1	153.0	139.2	153.6	10
Synthetic resins	111.4	102.3	97.7	101.4	4
Polyethylene[a]	115.8	100.0	92.2	90.3	–2
Polystyrene	127.6	114.0	109.9	114.9	5
Thermosets	119.7	115.1	112.3	127.8	14
Synthetic fibers	106.6	105.6	105.7	105.8	0
Agricultural chemicals	106.9	115.0	120.6	121.7	1
Mixed fertilizers	105.2	112.1	107.0	106.2	–1
Pharmaceuticals	125.2	130.6	134.6	136.3	1
Paints & varnish	114.5	119.7	121.4	122.1	1
Soaps & cleansers	116.0	118.0	118.3	118.4	0
Toilet preparations	112.9	116.8	119.5	121.4	2
Pigments, lakes & toners	106.7	107.7	108.2	112.1	4
Inks	103.1	104.4	104.7	105.6	1

a Includes both high- and low-density polyethylene. **Source:** Statistics Canada

6 Foreign Chemical Industries–JAPAN

Earlier this year, many of Japan's chemical industry leaders were expecting profits to improve in their 1994 fiscal year, which began April 1. At about the same time last year, they thought exactly the same thing about fiscal 1993. It didn't work out that way.

Chemical sales were down another 6% in fiscal 1993, according to C&EN's survey of 12 of Japan's top chemical companies. That makes 1993 the third successive year in which sales have declined. Worse yet, chemical profits plummeted a whopping 40% to their lowest levels since 1982.

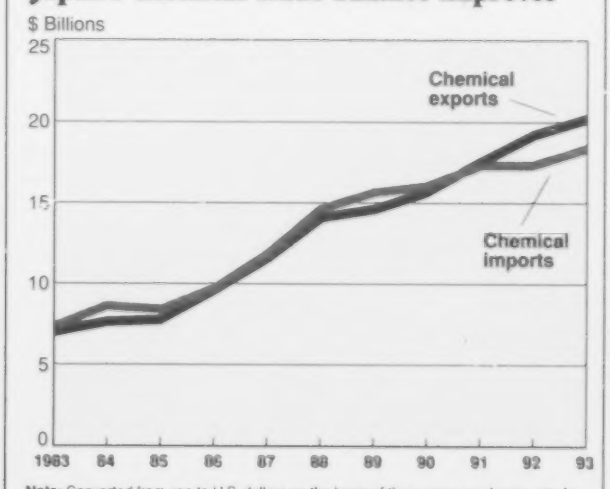
Things may not get much better this year. The Japan Petrochemical Industry Association recently noted that there is "no clear confirmation" that petrochemical markets have hit bottom. Many of those markets, such as cars and home appliances, have shown few signs of recovery. Low demand from its customers is exactly what caused Japan's chemical business to deteriorate last year.

INDUSTRY TRENDS: Weakness in many areas

Production index, 1990 = 100	1990	1991	1992	1993	% change 1992–93
All manufacturing	100.0	102.1	95.8	91.2	–5%
All chemicals	100.0	102.2	102.5	101.7	–1
Inorganic chemicals & pigments	100.0	101.2	96.2	90.9	–6
Alkalies & chlorine	100.0	99.1	97.0	94.2	–3
Organic chemicals	100.0	104.3	105.7	102.0	–4
Petrochemicals	100.0	102.9	104.5	102.0	–2
Aromatics	100.0	107.4	119.3	127.1	6
Cyclic intermediates & dyes	100.0	104.8	105.9	103.5	–2
Plastics	100.0	101.2	99.4	96.4	–3
Synthetic fibers	100.0	100.9	100.5	95.3	–5
Synthetic rubber	100.0	96.0	97.4	91.9	–6
Fertilizer	100.0	97.8	95.5	92.8	–3
Medicinals and drugs	100.0	102.7	102.6	102.8	0

Source: Ministry of International Trade & Industry

Japan's chemical trade balance improves



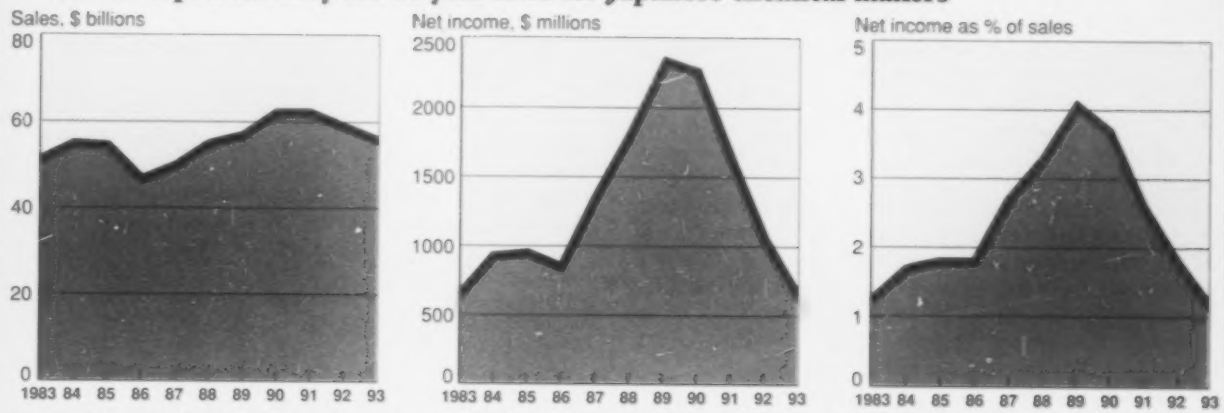
Note: Converted from yen to U.S. dollars on the basis of the average exchange rate for each year. **Source:** Ministry of International Trade & Industry

PRODUCTION: Very few chemicals gain

Thousands of metric tons, unless otherwise indicated	1990	1991	1992	1993	% change 1992–93
INORGANIC CHEMICALS					
Ammonia	1,831	1,855	1,788	1,708	–5%
Ammonium chloride	246	239	233	221	–5
Ammonium sulfate	1,803	1,781	1,830	1,681	–8
Calcium carbide	294	303	270	245	–9
Calcium superphosphate	472	420	396	393	–1
Carbon black	783	793	771	702	–9
Chlorine, liquid	1,042	1,027	978	900	–8
Hydrochloric acid	637	702	706	689	–2
Nitrogen[a]	8,299	8,767	9,129	8,957	–2
Oxygen[a]	8,787	9,000	8,067	7,946	–2
Sodium carbonate	1,135	1,104	1,057	1,056	0
Sodium hydroxide	3,917	3,905	3,866	3,777	–2
Sodium silicate	788	787	722	733	2
Sulfuric acid	6,887	7,057	7,100	6,937	–2
Titanium dioxide	280	279	252	246	–2
ORGANIC CHEMICALS					
Acetaldehyde	384	384	391	350	–11
Acetic acid	462	458	451	484	7
Acetone	334	369	377	350	–7
Acrylonitrile	593	604	621	594	–4
Benzene[b]	2,768	3,050	3,309	3,327	1
Butadiene	827	847	851	809	–5
Butanol	300	334	371	388	5
Caprolactam	509	531	548	510	–7
Cyclohexane	629	584	632	633	0
Dioctyl phthalate	295	305	297	279	–6
Ethylene	5,810	6,142	6,104	5,773	–5
Ethylene dichloride	2,660	2,642	2,708	2,735	1
Ethylene glycol	501	609	560	527	–6
Ethylene oxide	674	760	721	680	–6
Methanol	84	77	34	58	71
Octanol	283	295	327	312	–5
Phenol	403	495	538	513	–5
Phthalic anhydride[b]	161	162	165	152	–8
Propylene	4,215	4,431	4,536	4,272	–6
Propylene glycol	298	301	302	287	–5
Styrene	2,161	2,227	2,182	2,167	–1
Terephthalic acid	1,338	1,434	1,425	1,553	9
Toluene[b]	1,078	1,119	1,150	1,191	4
Toluene diisocyanate	116	136	132	137	4
Urea	776	730	725	725	0
Xylene[b]	2,652	2,918	3,203	3,462	8
PLASTICS					
Phenolic resins	385	383	356	328	–8
Polyethylene	2,888	2,982	2,980	2,762	–7
Polypropylene	1,942	1,963	2,038	1,950	–4
Polystyrene	2,097	2,121	2,005	1,966	–2
Polyvinyl chloride	2,049	2,055	1,981	1,980	0
SYNTHETIC RUBBER	1,426	1,377	1,388	1,310	–6

a Millions of cubic meters. b Petroleum-based product only.
Source: Ministry of International Trade & Industry

Income and profitability set 10-year lows for Japanese chemical makers



Note: Based on results of 12 leading Japanese chemical companies: Asahi Chemical, Dainippon Ink & Chemicals, Hitachi Chemical, Mitsubishi Kasei, Mitsubishi Petrochemical, Mitsui Toatsu Chemicals, Sekisui Chemical, Showa Denko, Sumitomo Chemical, Takeda Chemical Industries, Teijin, and Toray Industries. The fiscal year for most, but not all, of these companies ends March 31. Monetary statistics for all years converted from yen to U.S. dollars on the basis of the 1993 average exchange rate of $1.00 U.S. = 109.5 yen.
Sources: Toyo Keizai Shinposha, Nihon Keizai Shimbon America

COMPANY RESULTS: Income takes a beating as sales drop for most firms

$ Millions	Net sales	Net income	Profit margin[a]	Total assets	Employees (thousands)
Asahi Chemical Industry[b]					
1993	$8,557	$102.1	1.2%	$ 9,967	17.6
1992	9,084	151.6	1.7	10,077	18.1
1991	8,906	268.1	3.0	9,491	15.5
1990	8,817	353.4	4.0	9,121	15.3
Dainippon Ink & Chemicals[b]					
1993	$4,244	$57.2	1.3%	$6,315	7.3
1992	4,472	64.1	1.4	6,198	7.2
1991	4,727	72.5	1.5	5,910	7.0
1990	4,615	75.8	1.6	5,360	7.2
Hitachi Chemical[b]					
1993	$2,300	$19.5	0.8%	$1,802	5.2
1992	2,560	19.5	0.8	1,942	5.6
1991	2,843	9.7	0.3	2,002	5.8
1990	2,875	37.0	1.3	1,844	5.3
Mitsubishi Kasei[b]					
1993	$6,363	$ 29.2	0.5%	$8,695	11.3
1992	6,485	45.7	0.7	8,697	10.0
1991	6,644	48.8	0.7	9,555	9.3
1990	7,039	169.4	2.4	9,063	9.1
Mitsubishi Petrochemical[b]					
1993	$2,984	$ (42.5)[c]	—	$3,666	4.3
1992	3,400	59.8	1.8%	5,382	3.5
1991	3,716	141.2	3.8	5,732	3.4
1990	3,968	236.2	6.0	5,582	3.3
Mitsui Toatsu Chemicals[b]					
1993	$3,288	$ 2.9	0.1%	$6,035	5.6
1992	3,610	27.6	0.8	5,797	5.7
1991	3,857	65.0	1.7	5,822	5.6
1990	3,989	113.8	2.9	5,689	5.5

$ Millions	Net sales	Net income	Profit margin[a]	Total assets	Employees (thousands)
Sekisui Chemical[b]					
1993	$6,280	$102.3	1.6%	$6,075	6.0
1992	6,162	91.4	1.5	6,110	6.0
1991	5,938	194.2	3.3	5,765	5.8
1990	5,638	238.7	4.2	5,606	5.6
Showa Denko[d]					
1993	$4,227	$(208.2)[c]	—	$6,443	5.3
1992	4,648	(60.3)[c]	—	7,503	5.4
1991	5,269	1.8	0%	7,720	5.4
1990	5,204	103.4	2.0	7,195	5.3
Sumitomo Chemical[d]					
1993	$4,984	$(2.5)[c]	—	$7,774	8.0
1992	5,702	50.9	0.9%	7,778	8.0
1991	6,406	139.2	2.2	8,202	7.9
1990	6,548	151.5	2.3	7,391	7.8
Takeda Chemical Industries[b]					
1993	$5,131	$338.6	6.6%	$7,220	11.2
1992	5,160	288.6	5.6	7,074	11.2
1991	5,124	296.5	5.8	6,787	11.1
1990	5,032	339.0	6.7	6,641	11.0
Teijin[b]					
1993	$2,840	$ 69.4	2.4%	$5,110	7.6
1992	3,033	98.6	3.2	5,781	7.2
1991	3,098	136.0	4.4	5,342	6.8
1990	2,976	185.5	6.2	5,321	5.7
Toray Industries[b]					
1993	$4,835	$168.6	3.5%	$7,596	10.8
1992	5,300	219.3	4.1	7,587	10.7
1991	5,474	248.2	4.5	7,591	10.4
1990	5,348	264.8	5.0	6,864	10.3

Note: Monetary statistics for all years converted from yen to U.S. dollars on the basis of 1993 average exchange rate of $1.00 = 109.5 yen. **a** Net income as a percentage of sales. **b** Fiscal year ends March 31. **c** Net loss. **d** Fiscal year ends Dec. 31. **Sources:** Toyo Keizai Shinposha, Nihon Keizai Shimbon America

Foreign Chemical Industries–ASIA

Asia features some of the world's fastest developing economies, with China at the forefront. China's gross domestic product soared more than 13% in 1993 and industrial production leaped 21%. Output of some key chemicals rose strongly, with that of sodium carbonate up 16%, synthetic detergents 6%, and man-made fibers 4%. But production of pesticides fell 11%, sulfuric acid 7%, and ammonia 4%. China's chemical exports rose 11%, led by 20% growth in plastics and plastic products, 19% in rubber products, and 10% in organic chemicals.

Taiwan racked up 7% production growth last year both for chemicals and chemical products, far above the 2% rise for all manufacturing. Chemical sectors posting the best output gains were industrial catalysts and additives, 13%, plastics and resins, 10%, and synthetic rubber, 8%. Chemical exports, including plastics and rubber products, were up 6%, led by a 20% rise in inorganic chemicals.

South Korea's gross domestic product soared more than 10% in 1993. Output of chemicals and chemical products also jumped 10%, compared with 4% for all manufacturing. And chemical exports were up 10%.

Meanwhile, India's production of chemicals and chemical products last year rose 5%, with basic chemicals up 12%—compared with 1% growth for all manufacturing.

INDIA

INDUSTRY TRENDS: Basic chemicals soar

Industrial production index, 1981 = 100	1990	1991	1992	1993	% change 1992–93
All manufacturing	190.7	207.8	204.6	206.1	1%
Chemicals & chemical products	247.4	254.3	261.3	274.4	5
Basic chemicals	190.5	203.2	224.3	250.5	12
Fertilizers, pesticides	262.2	276.2	320.3	319.7	0
Drugs, medicines	322.4	305.1	280.2	277.5	–1
Detergents	160.0	164.5	162.3	160.3	–1
Rubber, petroleum, plastic & coal products	173.5	173.4	171.7	177.4	3

Note: Years end March 31. **Source:** Central Statistical Organization, India Ministry of Planning

PRODUCTION: Polymers make big gains

Thousands of metric tons	1990	1991	1992	1993	% change 1992–93
Fertilizer[a]	8,543	9,045	9,863	9,736	–1%
Nitrogen	6,747	6,993	7,301	7,430	2
Phosphate	1,796	2,052	2,562	2,306	–10
Sodium carbonate	1,377	1,385	1,409	1,391[b]	–1
Sodium hydroxide	933	992	1,036	1,079[b]	4
Nylon & polyester filament yarn	189	199	213	278[b]	30
Polyvinyl chloride resins	132	125	151	223[b]	47
Synthetic rubber	53	57	55	47[b]	–15

Note: Years end March 31. a Nutrient content basis, as N or P_2O_5. b Provisional value. **Source:** Central Statistical Organization, Indian government agencies

CHINA

FOREIGN TRADE: Chemical imports fall

$ Millions	1991	1992	1993	% change 1992–93
Total exports[a]	$71,910	$84,940	$91,763	8%
Total imports[b]	63,791	80,585	103,950	29
Overall trade balance	8,119	4,355	–12,187	–380
Chemical exports[a,c]	na	5,952	6,597	11
Organic chemicals	911	1,403	1,541	10
Inorganic chemicals	913	1,050	1,145	9
Dyeing, tanning, coloring materials	335	354	373	5
Pharmaceuticals[a]	743	460	427	–7
Essential oils, perfumes, cleansing materials	220	181	216	19
Plastics, plastic products	na	1,515	1,825	20
Rubber products	na	313	373	19
Chemical imports[b,c]	na	12,484	11,165	–11
Organic chemicals	1,884	1,876	1,708	–9
Inorganic chemicals	209	378	436	15
Dyeing, tanning, coloring materials	345	500	592	18
Pharmaceuticals	490	319	263	–18
Fertilizers[d]	3,229	3,004	1,479	–51
Plastics, plastic products	na	4,754	4,956	4
Rubber products	na	555	598	8
Chemical trade balance[c]	na	–6,532	–4,568	30

Note: Data supplied in U.S. dollars by the Chinese government. These values are not recalculated to reflect subsequent changes in monetary exchange rates. In many cases, figures for 1991 are not completely comparable with figures for subsequent years because of changes in plastics and rubber categories. These are indicated as na. a Free on board. b Includes cost, insurance, and freight. c Includes chemicals and related products, and plastic and rubber products. d Manufactured. **na** = Not available.
Source: General Administration of Customs of the People's Republic of China.

PRODUCTION: Largest volume chemicals dip

Thousands of metric tons	1990	1991	1992	1993	% change 1992–93
Synthetic ammonia	21,290	22,016	22,981	22,035	–4%
Fertilizer[a]	18,797	19,795	20,479	20,160	–2
Nitrogen	14,636	15,101	15,705	15,506	–1
Phosphate	4,114	4,597	4,622	4,652	1
Sulfuric acid[b]	11,969	13,329	14,087	13,140	–7
Sodium carbonate	3,795	3,936	4,550	5,300	16
Sodium hydroxide[b]	3,354	3,541	3,795	3,885	2
Plastics	2,270	2,830	3,308	3,354	1
Man-made fibers	1,654	1,910	2,132	2,215	4
Ethylene	1,572	1,761	2,003	2,040	2
Synthetic detergents	1,514	1,462	1,666	1,765	6
Benzene	562	726	803	832	4
Synthetic rubber	318	336	373	385	3
Pesticides[c]	228	255	281	249	–11

a Nutrient content basis, as N, P_2O_5, or K_2O. b 100%. c On basis of active substance.
Sources: State Statistical Bureau of the People's Republic of China, China Statistical Information & Consultancy Service Center

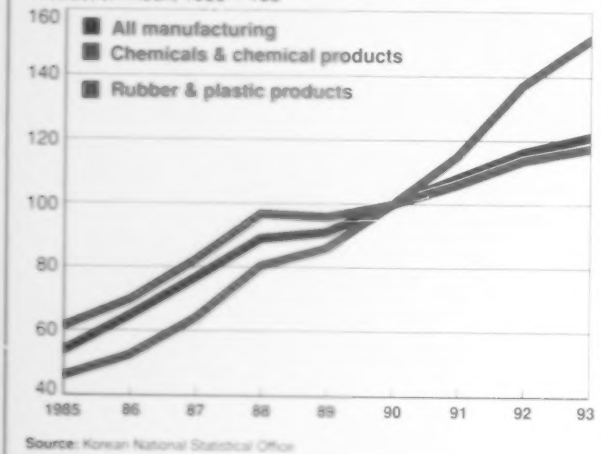
PRODUCTION: Petrochemicals, polymers lead strong overall growth

Thousands of metric tons	1990	1991	1992	1993	% change 1992–93
Ethylene	1,054	1,566	2,769	3,273	18%
Composite fertilizers	1,993	1,927	2,188	2,365	8
Propylene	608	855	1,482	1,808	22
Polypropylene	574	770	1,223	1,436	17
Polyethylene, high density	437	612	1,019	1,189	17
Benzene	381	561	964	1,139	18
Polyethylene, low density	404	552	761	853	12
Polystyrene	592	758	754	809	7
Polyvinyl chloride	526	602	726	760	5

Source: Korean National Statistical Office

Thousands of metric tons	1990	1991	1992	1993	% change 1992–93
Vinyl chloride	374	547	667	680	2%
Sodium hydroxide	332	385	524	507	–3
Butadiene	168	205	376	486	29
Acrylonitrile-butadiene-styrene	204	227	310	350	13
Synthetic detergents	342	363	360	339	–6
Carbon black	216	232	248	300	21
Paint	276	305	330	289	–12
Acrylonitrile	87	80	104	124	19

South Korea's growing overall economy supports booming chemical industry



Source: Korean National Statistical Office

FOREIGN TRADE: Chemical exports grow

$ Millions	1991	1992	1993	% change 1992–93
Exports[a]	$71,870	$76,632	$82,236	7%
Imports[b]	81,525	81,775	83,800	2
Trade balance	–9,655	–5,143	–1,564	70
Chemical exports[a,c]	3,191	4,455	4,922	10
Chemical elements & compounds	1,072	1,505	1,639	9
Chemical fertilizers	168	184	197	7
Chemical imports[b,c]	8,269	7,668	8,235	7
Organic chemicals	3,467	2,814	2,919	4
Plastics	1,382	1,356	1,516	12
Inorganic chemicals	782	786	870	11
Medicinal products	353	408	470	15
Chemical trade balance	–5,098	–3,213	–3,313	–3

Note: Data supplied in U.S. dollars by the South Korean government. These values are not recalculated to reflect subsequent changes in monetary exchange rates. a Free on board. b Includes cost, insurance, and freight. c Includes chemicals and related products.
Source: Korean Office of Customs Administration

INDUSTRY TRENDS: Chemicals do well

Index, 1990 = 100	1990	1991	1992	1993	% change 1992–93
Chemicals and chemical products					
Production	100.0	116.3	138.0	152.1	10%
Shipments	100.0	114.2	134.1	148.9	11
Inventories	100.0	145.8	181.7	203.5	12
Rubber and plastic products					
Production	100.0	108.3	114.8	119.9	4
Shipments	100.0	106.9	112.2	118.3	5
Inventories	100.0	121.5	125.2	132.7	6
All manufacturing					
Production	100.0	109.7	116.2	121.1	4
Shipments	100.0	109.8	116.6	122.9	5
Inventories	100.0	121.1	129.8	132.8	2

Source: Korean National Statistical Office

PRICES: Falling for chemicals, plastics

Producer price index, 1990 = 100	1990	1991	1992	1993	% change 1992–93
All commodities	100.0	104.7	107.0	108.6	1%
Chemical products	100.0	103.8	102.0	101.0	–1
Basic chemicals	100.0	100.5	94.9	91.2	–4
Synthetic rubber & plastic materials	100.0	106.0	94.4	90.0	–5
Chemical fibers	100.0	105.2	103.3	100.1	–3
Drugs, pharmaceuticals	100.0	101.1	104.0	104.5	0
Soaps, detergents & toiletries	100.0	103.5	106.7	111.3	4
Other chemical products	100.0	107.3	111.3	112.2	1
Rubber & plastic products	100.0	102.8	101.2	101.4	0
Rubber products	100.0	101.4	103.4	104.3	1
Plastic products	100.0	103.3	100.6	100.6	0

Source: Korean National Statistical Office

TAIWAN

INDUSTRY TRENDS: Chemicals and chemical products outperform all manufacturing

Industrial production index, 1991 = 100	1990	1991	1992	1993	% change 1992–93
All manufacturing	93.0	100.0	104.1	106.5	2%
Chemicals	88.7	100.0	114.0	121.8	7
Basic chemicals	95.0	100.0	112.5	118.5	5
Petrochemicals	90.2	100.0	112.8	120.9	7
Fertilizers	98.1	100.0	102.0	100.5	–1
Synthetic fibers	89.1	100.0	112.4	117.2	4
Plastics & resins	83.9	100.0	119.1	131.0	10
Synthetic rubber	90.4	100.0	102.0	110.3	8

Industrial production index, 1991 = 100	1990	1991	1992	1993	% change 1992–93
Chemical products	93.3	100.0	108.4	115.6	7%
Paints & varnishes	94.7	100.0	113.2	124.9	10
Drugs & medicines	98.4	100.0	105.9	106.2	0
Pesticides	101.8	100.0	102.3	100.4	–2
Industrial catalysts & additives	85.0	100.0	109.4	124.0	13
Rubber products	96.2	100.0	103.2	93.4	–10
Plastic products	98.1	100.0	96.0	90.8	–5

Source: Taiwan Ministry of Economic Affairs

FOREIGN TRADE: Chemical deficit rising

$ Millions	1991	1992	1993	% change 1992–93
Exports[a]	$76,178	$81,470	$84,935	4%
Imports[b]	62,861	72,007	77,061	7
Trade balance	13,317	9,463	7,874	–17
Chemical exports[a,c]	6,741	7,224	7,629	6
Organic chemicals	440	472	501	6
Inorganic chemicals	146	149	179	20
Dyeing, tanning, coloring materials	342	409	463	13
Pharmaceuticals	41	48	41	–16
Essential oils, perfumes, cleansing materials	161	158	170	8
Plastics, plastic products	4,581	4,815	5,011	4
Rubber products	590	640	682	7
Chemical imports[b,c]	9,339	9,565	10,156	6
Organic chemicals	3,654	3,599	3,801	6
Inorganic chemicals	746	754	708	–6
Dyeing, tanning, coloring materials	631	690	724	5
Pharmaceuticals	226	298	332	11
Essential oils, perfumes, cleansing materials	186	287	309	8
Plastics, plastic products	1,752	1,877	2,008	7
Rubber products	459	540	583	8
Chemical trade balance	–2,598	–2,341	–2,527	–8

Note: Data supplied in U.S. dollars by the Taiwan government. These values are not recalculated to reflect subsequent changes in monetary exchange rates. **a** Free on board. **b** Includes cost, insurance, and freight. **c** Includes chemicals and related products, and plastic and rubber products. **Source:** Taiwan Ministry of Finance

PRODUCTION: Up for most chemicals

Thousands of metric tons, unless otherwise noted	1990	1991	1992	1993	% change 1992–93
Polyester[a]	1,290	1,457	1,641	1,753	7%
Terephthalic acid[b]	798	1,005	1,302	1,635	26
Polyvinyl chloride	921	978	1,043	1,078	3
Vinyl chloride	665	595	650	780	20
Ethylene	776	709	734	742	1
Sulfuric acid	751	776	715	644	–10
Acrylonitrile-butadiene-styrene	384	472	569	642	13
Polystyrene	288	476	522	587	12
Paints	312	322	379	419	11
Propylene	398	389	401	418	4
Oxygen[c]	370	364	377	376	0
Ammonium sulfate	509	478	445	370	–17
Polyethylene[d]	360	334	360	369	2
Styrene	355	368	338	369	9
Hydrochloric acid	257	291	329	339	3
Calcium superphosphate	338	346	332	335	1
Benzene	249	234	267	276	4
Ammonia, anhydrous	263	296	272	267	–2
Urea	229	206	221	236	7
Dioctyl phthalate	188	192	225	210	–7
Hydrogen[c]	71	86	57	110	94
Phthalic anhydride	80	70	107	106	–1
Methyl methacrylate	3	30	56	76	37

a Filament and staple. **b** Pure terephthalic acid. **c** Millions of cubic meters. **d** Low and high density. **Source:** Taiwan Ministry of Economic Affairs